UNIVERSITY OF ALBERTA

Web Behaviour in Wood Composite Box Beams

BY

© EDWARD THOMAS LEWICKE

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Master of Science.

DEPARTMENT OF AGRICULTURAL ENGINEERING

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Abstract

Wood box beams are built up wood structural elements designed to resist flexural loads. Box beams are used in a variety of situations using materials suitable to the application. In general, box beams use materials very efficiently to provide high flexural strength and rigidity as well as high torsional rigidity at a low cost in terms of quantity of material used. Much of the previous research on wood box beams used beams with thin webs which had a low bending stiffness. None of the previous work investigated the use of materials that are commonly used as wall sheathing in normal wood frame construction, such as softwood plywood or oriented strandboard (OSB) 6.35 mm or thicker.

The objective of the study is to investigate the behaviour and strength of wood composite box beam webs in the areas of critical shear buckling load, ultimate post-buckling shear strength and shear deflection. Web panel aspect ratio and face grain orientation were the main variables investigated. Three samples of three types of beams with nominal 6.35 mm thick OSB webs, 'Paralam' parallel strand lumber flanges, and dimension lumber stiffeners were constructed and load tested to destruction to obtain data on out-of-plane web deflection, vertical deflection and ultimate shear strength.

Comparison with experimental results confirmed that published methods of determining critical shear load and shear deflection are valid for wood composite box beams with OSB webs. Using experimental results, a plane frame computer model was developed to predict the post buckling shear capacity of oriented strand board (OSB) web box beams using modified tension field action. Reducing the axial stiffness of compression elements in a plane frame model results in a model which agrees with the ultimate beam shear loads as determined by testing.

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Notation

a	Longer web panel dimension or distance from end of beam to applied concentrated load (mm)
A	Cross-sectional area of beam or a web element (mm^2)
b	Shorter web panel dimension or beam width (mm)
b_f	Flange width (mm)
b_x	Width of beam carrying shear associated with Q (mm)
B_a	Panel axial stiffness per unit width (N/mm)
B_v	Panel shear stiffness per unit width (N/mm)
c	Clear distance between flanges (mm)
c_w	Greater of y_c or y_t (mm)
C_c	Compressive force parallel to web compressive diagonal (N or kN)
D_a	Plate stiffness in subscript direction or plane (N-mm)
E_f	Elastic modulus of flange parallel to grain (MPa)
E_L	Elastic modulus as defined in Equation 2.9 (MPa)
E_{wa}	Elastic modulus of web in the direction of the second subscript (MPa)
E_{wc}	Elastic modulus along web panel compression diagonal (MPa)
E_{wt}	Elastic modulus along web panel tension diagonal (MPa)
EI	Beam stiffness (MPa)
$(EI)_e$	Effective beam stiffness about the horizontal axis ($N\text{-}mm^2$)
$(EI)_f$	Flange stiffness ($N\text{-}mm^2$)
$(EI)_2$	Effective stiffness of beam about its vertical axis ($N\text{-}mm^2$)

Notation

$f_{b\,cr}$	Critical bending stress for lateral buckling (MPa)
f_f	Lesser of flange tensile and compressive strengths (MPa)
f_{twa}	Web panel tensile strength in the direction of the second subscript (MPa)
f_{wxy}	Web shear strength (MPa)
G_f	Shear modulus of flange (MPa)
GK	Beam torsional rigidity (N-mm^2)
G_w	Shear modulus of web (MPa)
h	Beam depth (mm)
h_f	Flange depth (mm)
h_{gl}	Cross-sectional length of glue joint (mm)
I	Moment of inertia of web element (mm^4)
I_g	Moment of inertia of the gross cross-section of beam (mm^4)
I_n	Moment of inertia of the net cross-section of beam (mm^4)
$I^T{}_f$	Moment of inertia of beam cross-section transformed to flange properties (mm^4)
$I^T{}_w$	Moment of inertia of section transformed to web properties (mm^4)
J	Web moment of inertia, $t^3/12$ (mm^3)
k	Maximum shear stress divided by average shear stress
K	Shear section constant
L	Beam length (mm)
L_e	Effective beam length (mm)

Notation

M	Bending moment (kN-m)
p	Constant defined in Equation 2.35
P	Applied force (kN) or (N)
Q	First moment of area about the neutral axis (mm^3)
$Q^T{}_f$	First moment of area about the neutral axis transformed to flange properties (mm^3)
$Q^T{}_w$	First moment of area about the neutral axis transformed to web properties (mm^3)
s	Constant defined in Equation 2.36
t	Web thickness (mm)
v_{cr}	Web critical shear stress (MPa)
v_{gl}	Shear stress at the flange-web glue line (MPa)
V	Shear force (kN) or (N)
V_{cr}	Critical shear force (kN) or (N)
V_p	Panel shear strength per unit width (N/mm)
V_r	Beam shear resistance (kN)
x	Distance from end of beam (mm)
X_s	Shear section coefficient
y	Beam deflection or distance from lower face of beam
y_c	Distance from neutral axis to compression face (mm)

Notation

y_t	Distance from neutral axis to tension face (mm)
α	X axis constant used to determine the shear buckling constant
β	Curve number used to determine the shear buckling constant or a constant defined in Equation 2.31
Δ	Total deflection (mm)
Δ_s	Shear deflection (mm)
Δ_b	Flexural deflection (mm)
ν_a	Poisson's ratio of web, load applied in subscript direction
ν_{ab}	Poisson's ratio of web, first subscript indicates direction of secondary strain, second subscript indicates direction of primary strain
ρ	Coefficient defined in Equation 2.24
σ_c	Compressive stress in a web element (MPa)
θ	Angle between face grain and applied load (radians or degrees)

1 Introduction and Objective

1.1 Description

Wood box beams are built up wood structural elements designed to resist flexural loads. The flanges are longitudinal members at the top and bottom of the beam and the webs are wood panel sheathing applied both sides of the beam, (Figure 3.1). Stiffener/load blocks which transfer shear loads to the webs and control the size of the web panels are placed vertically at intervals along the beam length. For design purposes, as with many other types of non-prismatic beams, the flanges may be assumed to resist only flexural stresses and the webs may be assumed to resist only shear stresses. Box beam bending strength and stiffness are primarily a functions of flange size, beam depth, flange elastic modulus and flange tensile strength and can be specified to fit any application. Box beam shear strength and stiffness are primarily governed by the beam depth, web thickness, flange size, web tensile strength and web shear modulus.

1.2 Box Beam Uses

Box beams are used in a variety of situations using materials suitable to the application. In general, box beams use materials very efficiently to provide high flexural strength and rigidity as well as high torsional rigidity at a low cost in terms of quantity of material used. As a result of their high torsional rigidity, box beams have excellent resistance to lateral buckling. The high torsional rigidity of the box section makes it a popular choice to resist torsional loads in highway bridges especially curved exit ramps. Steel, aluminum and polymer/fibre composite box beams are frequently used in automotive and aircraft frames where stiff, strong, light weight structures are required. Wood box beams are occasionally used as lintels above store windows or as floor or roof beams in residential construction.

In spite of their efficiency, wood box beams are seldom used in building construction, primarily because the Alberta/National building code provisions governing design and construction of small wood frame structures require that box beams be designed by a professional engineer. Construction of wood box beams should be inspected by the designer to ensure that the beams are built in accordance with the design. The Canadian design code governing wood box beams, CSA/CAN O86.1-M89, is another reason that wood box beams are seldom used. The CSA/CAN O86.1-M89 design method uses the entire beam section to resist bending stresses. By using the web to resist flexural stresses, sophisticated web splices which are difficult to fabricate on site are required. While wood box beams are very efficient in terms of material use, the cost of labour to assemble box beams tends to reduce the advantage gained through efficient use of materials. In order to increase the competitiveness of wood box beams, more understanding of the behaviour of wood box beams is a must so that a simpler and more rational design method can be developed.

1.3 Materials

Due to its low cost and high strength, oriented strand board (OSB) is a popular choice for subfloors, wall and roof sheathing, and wood-I beam webs in light wood frame construction. OSB is a layered wood composite panel material composed of wood wafers pressed into panels. The outer layers of wood wafers are oriented parallel to the long dimension of the panel while the panel core generally has the wafers oriented perpendicular to the long panel dimension. OSB was selected for use as box beam webs in this study because it is a very common structural material whose behaviour as a beam web has not been thoroughly investigated.

One of the problems encountered using conventional dimension lumber for flanges in box beams is the need for splices. Wood composite lumber such as laminated veneer lumber, parallel strand lumber or glue laminated timber can be manufactured in lengths up to 18 m often eliminating the need for flange splices. In addition to eliminating splices, composite lumber manufacturers claim that composite lumber has a higher tensile strength and elastic modulus than sawn lumber with less variation in properties. One such composite lumber, Paralam, parallel strand lumber manufactured by Trus-Joist MacMillan, consists of strands of Douglas fir approximately 3 mm thick and 10 mm wide which are glued together in a variety of cross-sections in lengths up to 18.3 m. Paralam, 89 mm x 89 mm, was selected as the flange material to ensure that the flanges would have sufficient strength so that the beam webs would buckle before the flanges failed in tension or compression and to match the width of 38 mm x 89 mm stiffener/load blocks.

The stiffener/load blocks do not carry a significant load in box beams, functioning primarily to transfer shear loads from the flanges to the webs and to stabilize the web. Sawn lumber, 38 mm x 89 mm No. 2 or better S-P-F, was selected as the stiffener/load block material.

1.4 Objective

This research is to investigate the behaviour and strength of the web of wood composite box beams. As box beam webs are subjected to loading in shear, some combinations of loading and web panel size can result in stability problems such as web buckling. The objectives are:

1. Attempt to develop a method of predicting the ultimate shear strength of OSB box beam webs.
2. Test the applicability to OSB beam webs of the previously developed method of predicting critical shear loads for orthotropic plates.
3. Compare various methods of estimating shear deflection in wood composite box beams to determine which method predicts box beam shear deflection most accurately.

1.5 Scope

The OSB web materials were tested to determine the elastic modulus and tensile strength, Poisson's ratio and shear modulus. Flange and stiffener/load block materials were tested to determine the elastic modulus. Beams were constructed to determine the effect of panel size and face grain orientation. A total of ten beams, one pilot test beam and three samples of each of three types of beams were constructed with varying face grain direction and stiffener/load block spacing and load tested to destruction. The data obtained from the testing program included out-of-plane web deflection vs. load, vertical deflection vs. load and ultimate load capacity. The test results were compared with the critical shear force and deflection predicted by theory, as reflected in various design methods. A plane frame model was also used to simulate the diagonal tensile web stress and vertical deflection. The plane frame model results were compared with the deflection measured in the tests and deflection calculated using the various design methods.

2 Literature Review

2.1 Introduction

Very little has been published on box beams with wood panel webs. Most of the published material consists of design manuals produced by government, regulatory agencies or industry groups. Publications on the theory behind wood box beams and results of box beam tests are limited to a series of reports issued by the United States Department of Agriculture, Forest Products Laboratory, Madison, WI during the Second World War, (Withey, 1943; Lewis and Dawley, 1943; Lewis et al. 1943, 1944a, 1944b, 1944c). Supporting the Forest Products Laboratory (FPL) work on box beams was a series of reports on "Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear," (March 1942a, 1942b, 1942c, 1943a, 1943b; Norris and Voss 1943a, 1943b, 1943c; Norris et al. 1945; Voss et al. 1950). Some other reports dealing with specific areas associated with hardboard web box beams and I beams used in Europe are also available but do not present a generalized box beam theory (Hilson and Rodd, 1979; McNatt, 1980). Nearly all available material on wood panel web box beams deals with thin webs, less than 6 mm, that have low bending stiffness. No test results involving wood box beams using web materials normally used in North American wood frame construction, such as softwood plywood or OSB 9.5 mm or more in thickness, appear to have been published.

2.2 Behaviour of Plates Subjected to Shear Forces

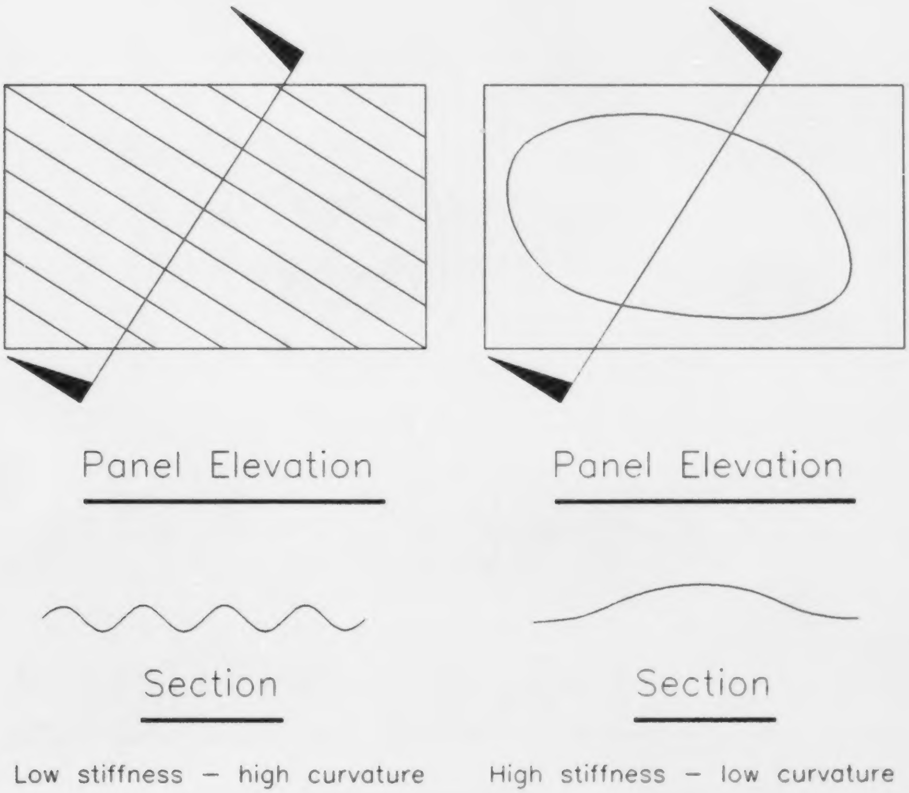
Two dimensional structural elements can be divided into two categories, membranes and shells. Membranes are considered to have negligible bending stiffness while shells have an appreciable bending stiffness. Plates are a special case of shell and are nominally flat before application of load. The following discussion of plates will be limited to a very general discussion of the behaviour of plates subjected to shear loads.

The webs of a wood box beam are glued to flanges and stiffener/load blocks and can be considered to be plates with fixed or semi-fixed edges. As a load is applied to a beam, the webs undergo a small change of shape from rectangles to irregular parallelograms due to the combined effect of shear and flexural deflection. Assuming that there is a very small change in length in the boundary elements of a web plate, the length of the web plate diagonals must change due to the change in shape as the panels deflect. Considering the web as a series of elements parallel to the diagonals, compressive elements act as columns subject to buckling and tension elements tend to maintain a straight line parallel to the panel's original plane (Thorburn et al, 1983),

In a real beam web, the web is not divided into discrete elements. Below the critical shear force, the maximum force at which the web can maintain a small out-of-plane deformation, the tensile stresses act as a bracing force on the compressive stresses allowing the compressive stresses to continue to increase above the column buckling stress. After buckling, as the out-of-plane deformation increases, the increased length due to out-of-plane deformation allows the compression web panel diagonal to tend to return to its original length, resulting in reduced compressive stress. This increase in strength beyond buckling is known as tension field action or post-buckling strength.

If the flexural stiffness of the plate is low, as in the case with thin aluminum- or wood-webs, the out-of-plane deformation tends to take the form of sinusoidal ripples approximately 45° to the beam axis. The exact orientation of the ripples is a function of panel aspect ratio, the ratio of the longer panel dimension to the shorter panel dimension and orthotropic elastic moduli. With increasing web stiffness, the rate of change of the web slope, web curvature, decreases resulting in fewer and larger ripples with a limit of a single compound curve (Figure 2.1).

In a plate with low bending stiffness, many small ripples are formed parallel to the tension diagonal (Figure 2.1). In this case, the tensile stresses in the plate are very close to the stresses that would be determined using a plane frame model assuming that stiffness in the compressive direction is zero. With greater web stiffness, the compressive stiffness is not equal to zero, a single out-of-plane bulge develops. A plane frame model is not capable of taking into account the change in length of the tension diagonal due to out-of-plane deformation and will predict a maximum tensile stress which is lower than the actual tensile stress. To correct for this low estimate, the model's stiffness in the compressive direction must be greater than zero but less than the compressive stiffness of the undeformed web. A plane frame model using modified tension field action to allow for the effect of out-of-plane deformation as described above, however, is an approximate but useful tool to predict plate stresses and in-plane deformation.



Low stiffness – high curvature

High stiffness – low curvature

Figure 2.1 - Web Stiffness and curvature.

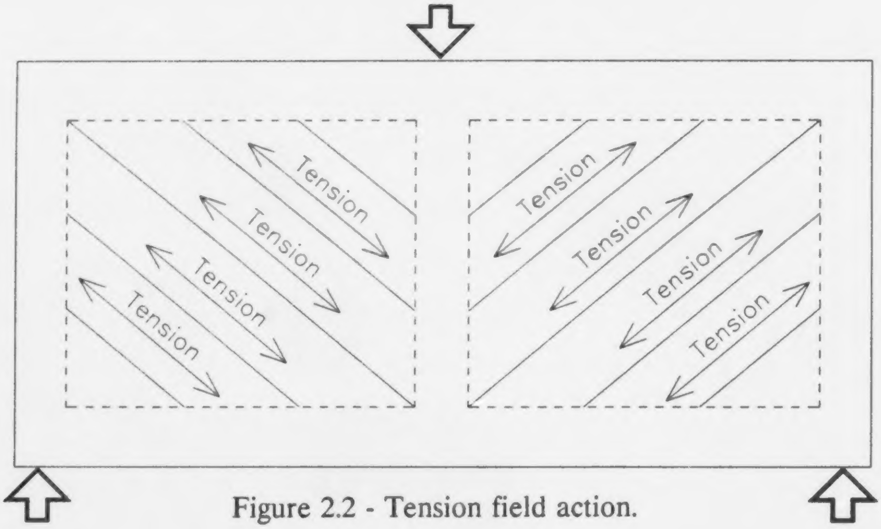


Figure 2.2 - Tension field action.

2.3 Box Beam Action

When a load is applied to a box beam with wood panel webs, shear forces are resisted by both the flanges and the webs with the majority of the shear force resisted by the webs. The capacity of the webs to resist shear force is a function of web thickness, orthotropic elastic moduli, web panel dimensions and tensile strength. As the applied load increases, the web goes through two different modes of resisting the applied force (Kuhn et al., 1952). The first mode can be described as an in-plane mode, no out-of-plane deformation, with active compression and tension diagonals. Web diagonal tensile and compressive stresses are directly proportional to load. In the second mode, after buckling commences, the portion of the shear force resisted by the compression diagonal decreases due to buckling. The tension diagonal resists an increasing proportion of the shear force until the web panel fails in tension, often referred to as tension field action (Figure 2.2). Out-of-plane deformation, wrinkles or bulges, in the web panels, allows the web to tend to return to its original length in the compression direction. When the out-of-plane deformation results in displacement of the centre of the web panel away from its original plane, the out-of-plane deformation has the effect of increasing the length of the tension diagonal. This can be seen in Figure 2.1 where the length of the line representing the deformed tension diagonal is longer than the straight line distance between the line's end points in the stiffer panel.

In wood composite box beams, the web is fixed or semi fixed to the flanges and stiffeners with little or no out-of-plane deflection or change of slope around the panel perimeter, so that the deflected shape of the web at failure is approximately sinusoidal or fourth degree polynomial. Before failure other web deformation modes such as full wave sinusoidal may occur. In these cases, usually one side of the sine wave will grow more quickly than the other and form a half wave bulge as failure is approached (Norris and Voss, 1945). As the out-of-plane deflection increases, the rate of change of the panel slope, bending moment, also increases with an inverse relationship to panel stiffness. Web stresses due to combined bending and compression, in some cases, can cause a bending failure. Equation 2.1 shows, in general terms, the effect of combined compressive stress due to axial compressive load and flexural stress due to out-of-plane web deflection on a compressive web element.

$$\sigma_c = \frac{Mt}{2I} + \frac{C_c}{A} \qquad 2.1$$

where

$$M = \frac{d^2y}{dx^2} EI \qquad 2.2$$

2.4 Previous Research

The early research work on wood box beams recognized that web buckling was a problem but the means of predicting critical loads were not available (Trayer and March, 1930). Seydel (1933) satisfied the need for information on shear stability by presenting a method of predicting the critical shear stress in rectangular orthotropic plates. Seydel's (1933) work was based on analytical methods developed by Timoshenko (1921) and Bergmann and Reissner (1932). Plate stiffnesses parallel to the direction of panel edges and a shear buckling constant are used to determine the critical shear stress. Seydel (1933) used a family of curves to determine the shear buckling constant, as shown in Figure 2.3, which is related to the panel aspect ratio and orthotropic plate stiffness. Seydel (1933) presents experimental results that confirm his method of predicting critical shear loads. Timoshenko and Gere (1961) use Seydel's (1933) method of predicting critical buckling stress and confirm that Seydel's method produces results that are consistent with theory for an infinitely long plate.

The following approach was used in Seydel (1933). The plate stiffness in both orthotropic directions, D_a and D_b, and the plate shear stiffness, D_{ab} are calculated.

$$D_a = \frac{E_{wa} J}{1 - \nu_a \nu_b} \tag{2.3}$$

$$D_b = \frac{E_{wb} J}{1 - \nu_a \nu_b} \tag{2.4}$$

$$D_{ab} = \nu_a D_b + 2\ (GJ)_{ab} = \nu_b D_a + 2\ (GJ) \tag{2.5}$$

where

$$J = \frac{t^3}{12} \tag{2.6}$$

Using the plate stiffnesses, the curve number, β, for use with Figure 2.3 is calculated.

$$\beta = \frac{D_{ab}}{\sqrt{D_a D_b}} \leq 1 \tag{2.7}$$

The FPL (1987) approximates β as

$$\beta = \frac{0.17\ E_L}{\sqrt{E_{wa} E_{wb}}} \leq 1 \tag{2.8}$$

where

$$E_L = \frac{20}{21}\ (E_{wa} + E_{wb}) \tag{2.9}$$

(Norris and Voss, 1945)

The x axis number, α, a function of panel aspect ratio, for use with Figure 2.3 is:

$$\alpha = \frac{b}{a}\sqrt[4]{\frac{D_a}{D_b}} \leq 1 \qquad 2.10$$

which can be simplified to

$$\alpha = \frac{b}{a}\sqrt[4]{\frac{E_{wa}}{E_{wb}}} \leq 1 \qquad 2.11$$

If α is greater than 1, the shorter side of the plate must be designated 'side a' and the longer side designated 'side b' and α and β must be re-calculated. Finding K_s using Figure 2.3, the critical shear stress per panel, v_{cr}, is calculated.

$$v_{cr} = K_s \frac{\sqrt[4]{D_a D_b^3}}{(b/2)^2 t} \qquad 2.12$$

which can be simplified to

$$v_{cr} = \frac{K_s t^2}{3 b^2 (1-\nu_a \nu_b)} \sqrt[4]{E_{wa} E_{wb}^3} \qquad 2.13$$

The curves shown in Figure 2.3 can also be expressed by a polynomial, Equation 2.14, fitted to the original curves shown in Seydel (1933).

$$\begin{aligned} K_s = {} & (8.14 + 5.04\alpha) \\ & + (1.64 + 0.412\alpha)\,\beta \\ & - (2.63 - 4.65\alpha)\,\beta^2 \\ & + (4.70 + 0.990\alpha)\,\beta^3 \end{aligned} \qquad 2.14$$

The FPL used Seydel's (1933) work as the basis for extensive experiments which investigated the behaviour of plywood plates loaded in shear and/or compression. The results were reported in FPL Report series 1316 (March, 1942a,

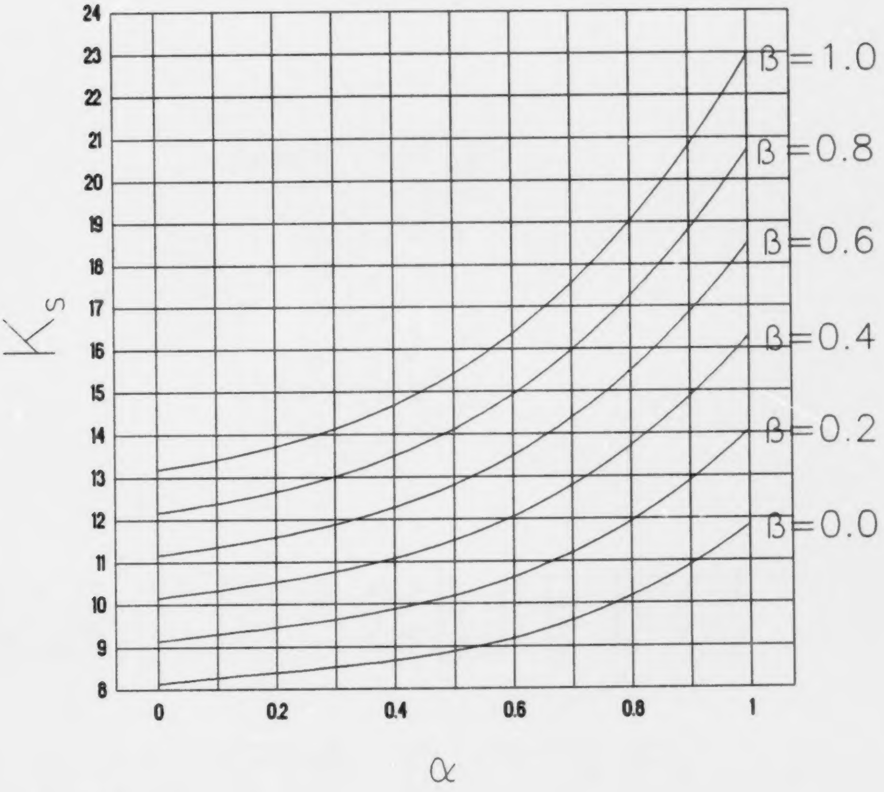


Figure 2.3 - Curves used to determine the shear buckling coefficient

1942b, 1942c, 1943a, 1942b; Norris and Voss, 1943a, 1943b, 1943c, 1945; Voss et al. 1950). In another series of reports, FPL Report Series 1318 (Lewis and Dawley, 1943, Lewis et al. 1943, 1944a, 1944b, 1944c) researchers at the FPL investigated the behaviour of plywood web box beams. The purpose of both series of FPL reports was to examine the use of plywood web box beams for use as aircraft components. In both the investigations of wood panel plates and box beams, the web panels were thin hardwood plywood with a low bending stiffness. Report 1316 (March, 1942a) showed an explanation, using energy methods, of Seydel's method.

Later work on shear buckling in plates, summarized in National Advisory Committee on Aeronautics (NACA) Technical Note 2661 (Kuhn et al. 1952), is based on thin aluminum plates with a negligible bending stiffness. The methods contained in this document are related to aircraft design using aluminum and are not directly applicable to wood.

In the textbook Theory of Elastic Stability (Timoshenko and Gere, 1961), the authors discuss post-buckling behaviour of metallic beam webs and tension field action based on membrane theory (negligible bending stiffness). All shear stresses are considered to be resisted by a field of tension members parallel to the tension diagonal of the panel.

2.5 Box Beam Design Methods

Several box beam design manuals are available North American sources, including CAN/CSA-O86.1-M89 (Canadian Standard Association, 1989), Wood Handbook (Forest Products Laboratory, 1987), Plywood Design Specification, Supplement Two, Design and Fabrication of Plywood Lumber Beams (American Plywood Association, 1990) and Design of Glued and Nailed Plywood Web Beams (Council of Forest Industries of British Columbia, 1989). All of the design methods use almost identical theory, however there are slight differences between the different design approaches in determining beam strength and stiffness and the degree of detail with which web stability is examined. The main differences between the different methods are notation, the method of converting basic beam dimensions into section properties and the assumptions regarding which beam elements resist normal stresses. The notation in the following descriptions of design calculations has been revised from the original publications to facilitate comparison of the different methods and to provide notation consistent with the rest of this paper.

All modification factors have been omitted from the description of the CAN/CSA-O86.1-M89 design method for clarity and to facilitate comparison to other design methods. CAN/CSA-O86.1-M89 uses an effective stiffness, the sum of web and flanges stiffnesses, $(EI)_e$, for all strength and deflection calculations.

$$(EI)_e = (\Sigma B_a)\,\frac{(y_t^3 + y_c^3)}{3} + (EI)_f \qquad 2.15$$

By using the effective stiffness to calculate bending strength, the design uses the web to resist a portion of the bending stresses and requires web splices to resist tensile stress. In the shear and moment resistance calculations, the effective stiffness is divided by the flange elastic modulus or a sum of the flange elastic modulus and web axial stiffness to effectively use a transformed moment of inertia in the calculations.

$$M = f_f\,\frac{(EI)_e}{E_f\,c_w} \qquad 2.16$$

Shear stress at the neutral axis is:

$$V = V_p\,\frac{(EI)_e}{E_f\,Q_f^T + 0.5\,\Sigma B_a\,c_w^2} \qquad 2.17$$

CAN/CSA-O86.1 also requires that the shear stress at the glue line be checked.

$$V = v_{gl}\,\Sigma h_g\,\frac{(EI)_e}{E_f Q_f^T} \qquad 2.18$$

The deflection due to moment, concentrated load at mid-span, is calculated by using the effective stiffness directly

$$\Delta_b = \frac{M\,L^2}{12\,(EI)_e} \tag{2.19}$$

Shear deflection is calculated by dividing the bending moment by the shear rigidity and an area term consisting of the effective stiffness divided by the axial stiffness of the web times the beam depth squared and a section shear coefficient.

$$\Delta_s = \frac{\Sigma B_a\,M\,h^2\,X_s}{\Sigma B_v\,(EI)_e} \tag{2.20}$$

The section shear coefficient corrects the area term to allow for the non-uniform distribution of shear stress over the section depth.

$$X_s = \frac{1}{I\,h^2}\int_{y=0}^{y=h} \frac{Q^2\,dy}{b_x} \tag{2.21}$$

CAN/CSA-O86.1 provides guidelines for lateral stability based on the I_x/I_y ratio but neglects web buckling.

The Wood Handbook (Forest Products Laboratory, 1987) presents all formulae using basic beam dimensions and elastic properties. Like CAN/CSA-O86.1 (1989), the FPL (1987) uses the entire beam cross-section, including the web to determine bending and shear strength. Flange stresses are determined by dividing the bending moment by the transformed section modulus expressed in terms of beam dimensions and elastic moduli.

$$f_f = \frac{6\,M}{(h^3 - c^3)\,\frac{b_f}{h} + \frac{E_{wx}\,\Sigma t\,h^2}{E_f}} \tag{2.22}$$

Shear stress is calculated by dividing shear force times the transformed first moment of area by web thickness times the transformed moment of inertia. The transformed moment of area and moment of inertia are both expressed in terms of basic beam dimensions.

$$f_{xy} = \frac{3\ V}{2\ \Sigma t} \left[\frac{E_f\,(h^2 - c^2)b_f + E_{wx}\ \Sigma t\ h^2}{E_f\,(h^3 - c^3)b_f + E_{wx}\ \Sigma t\ h^3} \right] \qquad 2.23$$

The effective beam stiffness, $(EI)_e$, is used to find the flexural deflection, shown here for a concentrated load at mid-span.

$$\Delta_b = \frac{M\ L^2}{12\ (EI)_e} \qquad 2.24$$

where

$$(EI)_e = \frac{1}{12}\,[E_f\,(h^3 - c^3)b_f + E_{wx}\ \Sigma t\ h^3] \qquad 2.25$$

Shear deflection is determined by dividing the bending moment by the web shear modulus times the web cross-sectional area.

$$\Delta_s = \frac{M_{max}}{G\ c\ \Sigma t} \qquad 2.26$$

The calculated shear deflection neglects the contribution of the flanges to shear stiffness and should be greater than the actual shear deflection. The Wood Handbook (1987) also provides for the calculation of a critical bending stress for lateral buckling based on the beam's lateral stiffness $(EI)_2$ and the torsional rigidity (GK).

$$f_{b\,cr} = \frac{\pi^2 E_f}{\rho^2} \qquad 2.27$$

where

$$(EI)_2 = \frac{1}{12} E_f (h - c)\, b_f^3 + E_{wx} [(b_f + \Sigma t)^3 - b_f^3]\, h \qquad 2.28$$

$$GK = \left[\frac{(h + c)(h^2 - c^2)(b_f + t)^2 t}{(h^2 - c^2) + 4 (b_f + t)\, t} \right] G \qquad 2.29$$

$$\rho = \sqrt{2\pi}\, \sqrt[4]{\frac{(EI)_2}{GK}}\, \sqrt{\frac{L_e h}{b}} \qquad 2.30$$

L_e can be calculated as shown in Table 2.1.

The Wood Handbook (1987) uses Seydel's method (1933), described previously in this chapter, to determine the critical shear stress for web buckling. The only significant deviation from Seydel's method is the equation used to calculate shear stress (Equation 2.31). The Wood Handbook (1987) neglects the $(1 - \nu_a \nu_b)$ in the denominator of Equation 2.13. March (1942a) gives this term a value of 0.99. Bodig and Jayne's (1982) value of 0.3 for the Poisson's ratio for wood composites would result in $(1-\nu_a \nu_b)$ value of 0.91. The effect of this omission is an estimate of critical buckling stress that is between 1% and 10% higher than would be calculated using Equation 2.13.

$$v_{cr} = \frac{K_s t^2}{3 b^2} \sqrt[4]{E_{wa} E_{wb}^3} \qquad 2.31$$

Table 2.1 - Box Beam Effective Length

Support	Load	Effective Length, L_e
Simple	Equal end moments	L
"	Conc. load at centre	0.742 L/(1-2h/L)
"	Uniform Load	0.887 L/(1-2h/L)
Cantilever	Conc. load at end	0.783 L/(1-2h/L)
"	Uniform Load	0.489 L(/1-2h/L)

The Plywood Design Specification, Supplement Two, Design and Fabrication of Plywood-Lumber Beams (American Plywood Association, 1990) is based on the assumption that bending stresses are resisted by the continuous parallel grain in the flanges and webs as described in Plywood Design Specification (American Plywood Association, 1986). The bending moment resisted by a beam is calculated using a net moment of inertia based on continuous parallel grain material.

$$M = \frac{f_f I_n}{0.5 h} \qquad 2.32$$

Beam shear strength is based on the moment of inertia and first moment of area of all parallel grain material regardless of butt joints.

$$V = \frac{f_{xy}\, I_g\, \Sigma t}{Q} \qquad 2.33$$

Deflection is calculated as the sum of the bending deflection and shear deflection. Bending deflection calculations use the moment of inertia of all parallel grain material regardless of butt joints. Shear deflection is found by dividing the product of the bending moment and a shear section constant, K, by the product of the beam cross-sectional, area using an effective web thickness, times the web shear modulus.

$$\Delta_s = \frac{K\, M}{A\, G} \qquad 2.34$$

where

$$K = \frac{\frac{9}{2}\left[\frac{1}{p}\ (1-s)+s\right]}{\left[\frac{1}{p}(1-s^3)+s^3\right]^2 \left(\frac{1}{p^2}\left[\frac{s^5}{2}-s^3+\frac{s}{2}\right]+\frac{1}{p}\left[-s^5\left(\frac{3}{30\beta}+\frac{2}{3}\right)+s^3\left(\frac{1}{3\beta}+\frac{2}{3}\right)-\frac{s}{2\beta}+\frac{8}{30\beta}\right]+\frac{8s^5}{30}\right)} \qquad 2.35$$

$$p = \frac{\Sigma t}{b} \qquad 2.36$$

$$s = \frac{c}{h} \qquad 2.37$$

$$\beta = \frac{G_f}{G_w} \qquad 2.38$$

The American Plywood Association (APA) also describes an approximate method of estimating total deflection by multiplying bending deflection by a constant which is related to the span/depth ratio. Web buckling is covered by recommending a maximum stiffener spacing of 1220 mm. The I_x/I_y ratio is used to determine the required degree of lateral bracing which increases with increasing I_x/I_y.

The booklet Design of Glued and Nailed Plywood Web Beams (Council of Forest Industries of British Columbia, 1989) is essentially a restatement of the APA's publication on box beam design with changes in the method of calculating shear deflection and a provision for web stability. The shear deflection calculations are identical to those used in CAN/CSA-O86.1-M89. Web buckling is covered by a graph which specifies stiffener spacing as a function of web thickness and distance between flanges.

3 Experimental Program

3.1 Introduction

In order to examine the presently available methods of predicting critical shear force and shear deflection in wood composite box beams, and to obtain data for use in developing a method of predicting the ultimate shear capacity of wood composite box beams, the following testing program was undertaken at the I. F. Morrison Structural Engineering Laboratory at the University of Alberta from July to December, 1991.

3.2 Test Specimens

As OSB beam webs were the focus of this study, the test beams were designed to ensure that the flanges would not fail due to flexural stresses before the web failed due to the shear load. The method described by Seydel (1933) was used to determine the load at which a wood box beam with 9.5 mm thick OSB webs in panels 432 mm x 563 mm would begin to buckle. Multiplying the web buckling shear force by six provided a design total load which would allow the web to buckle and exhibit post-buckling behaviour (tension field action). The bending moment calculated using this design load was then used to determine the required flange size. Trus-Joist MacMillan 'Paralam', parallel strand lumber, 89 mm x 89 mm, was selected for the flange based on a beam depth of 610 mm.

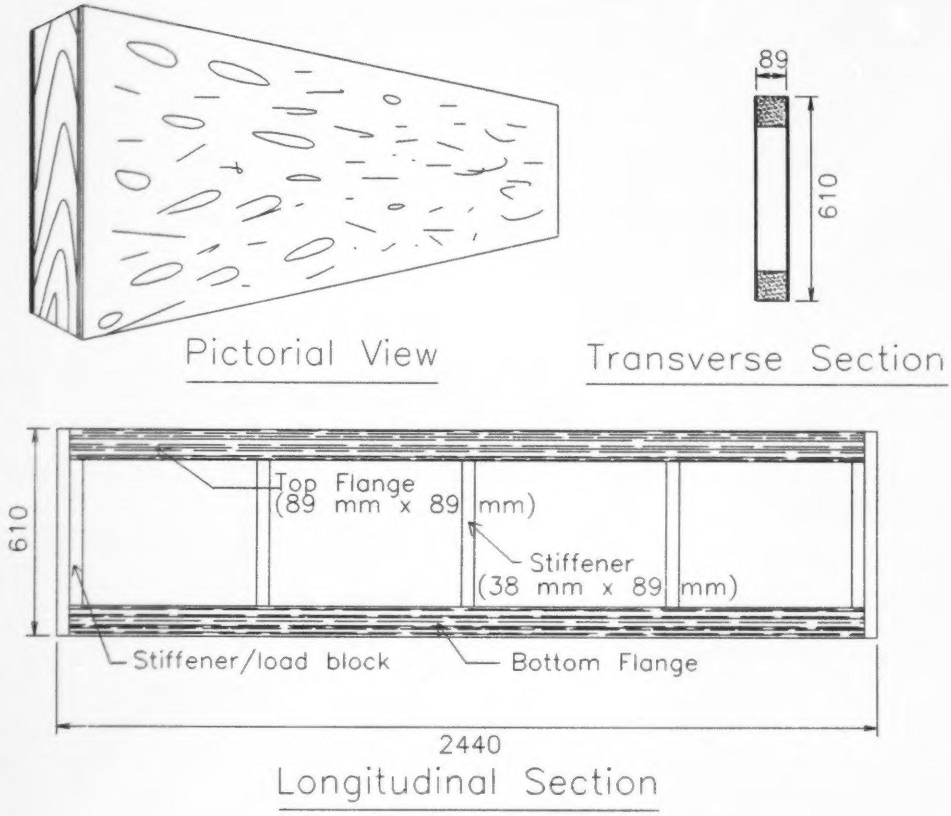

Pictorial View
89
610
Transverse Section
Top Flange
(89 mm x 89 mm)
610
Stiffener
(38 mm x 89 mm)
Stiffener/load block
Bottom Flange
2440
Longitudinal Section

Figure 3.1 - Box beam pictorial view, longitudinal section and transverse section

The 610 mm depth results in a beam with sufficient bending strength to ensure that the samples will not fail in bending. This depth of beam also results in large enough web panels to buckle at relatively low shear forces and makes economical use of standard 1220 mm wide OSB panels. The length of standard panels, 2440 mm, dictated the beam length.

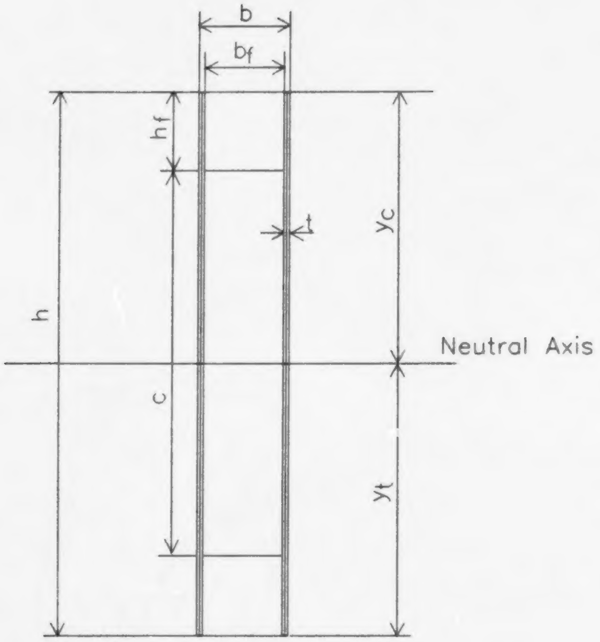
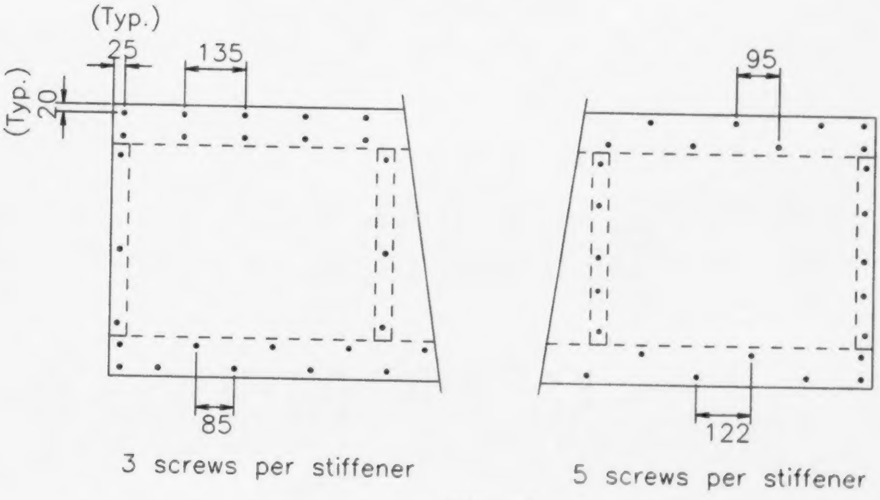


Figure 3.2 - Box beam transverse section

Spruce-Pine-Fir species group (S-P-F), No. 2 grade or better 38 mm x 89 mm stiffener/load blocks were located at the ends of the beams, at location of the applied loads, and at mid span when 610 mm stiffener spacing was used, as shown in Figure 3.1. In the type C beams (details of each type of beam will be discussed later), where a web splice was required at mid-span, two 38 x 89 stiffeners were glued together to provide a wide surface to which both web panel could be attached. The stiffener/load blocks fit snugly between the inner faces of the flanges but were not mechanically connected to the flanges except at the top and bottom of the ends of the beams to hold the flanges in place during assembly.

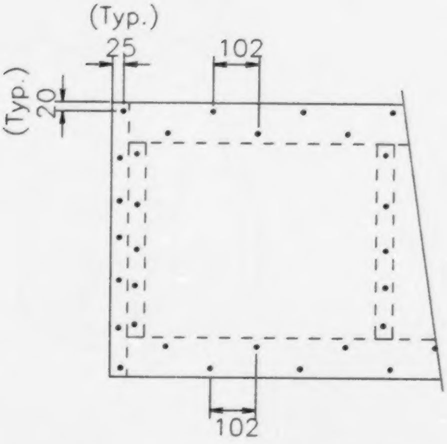
The primary means of attaching webs to flanges and stiffener/load blocks was Cascophen LT-75 Phenol-resorcinol adhesive, produced by Borden Chemicals Western, a division of The Borden Company, Limited. The adhesive was applied at a rate 450 g/m^2 using a notched trowel with 3 mm notches 3 mm apart. Glue clamping pressure was provided by 32 mm long drywall screws which also acted as a secondary method of web attachment. The pilot test beam used several different screw arrangements and spacings in order to determine the optimum screw spacing (Figure 3.3). Screw spacing of 100 mm on centre appeared to provide adequate glue clamping in the pilot test beam and was used in the subsequent test beams Figure 3.4.



Scale 1:15

Figure 3.3 - Pilot test screw spacing

In order to study the effect of web panel dimensions and grain orientation, one preliminary beam and three types of test beam, Types A, B and C, were constructed. Each series of test beam consisted of three samples with as little difference between samples as possible. The preliminary beam had nominal 9.5 mm thick webs with the web face grain oriented horizontally, stiffeners at quarter span and mid-span. Beam types A, B and C used nominal 6.35 mm thick OSB webs. Each type of beam used OSB panels from different production runs.



5 screws per interior stiffener

7 screws in end stiffeners

Scale 1:15

Figure 3.4 - Test beam screw spacing

The pilot test beam used single 38 mm x 89 mm x 432 mm long load blocks with the flanges extending the full length of the beam, 2440 mm, (Figure 3.5). This beam used nominal 9.5 mm (actual 10.22 mm) thick OSB webs with the face grain horizontal. The beam was designed for the load to be applied at mid-span so that all web panels would be loaded in shear.

Based on the experience gained from the pilot test, the Type A beams used nominal 6.35 mm (actual 6.92 mm) thick OSB webs. The web thickness was reduced so that the webs would buckle at lower loads. Single stiffener/load blocks were located 610 mm and 1220 mm from the beam ends. The end stiffener/load blocks were double 38 mm x 89 mm S-P-F with the outer ply extended the entire depth of the beam, 610 mm, and the inner ply bearing on the inner faces of the flanges (Figure 3.6). The flange was shortened to 2362 mm to allow for the extended end load blocks. Load was applied to the top flange 610 mm from the ends of the beams.

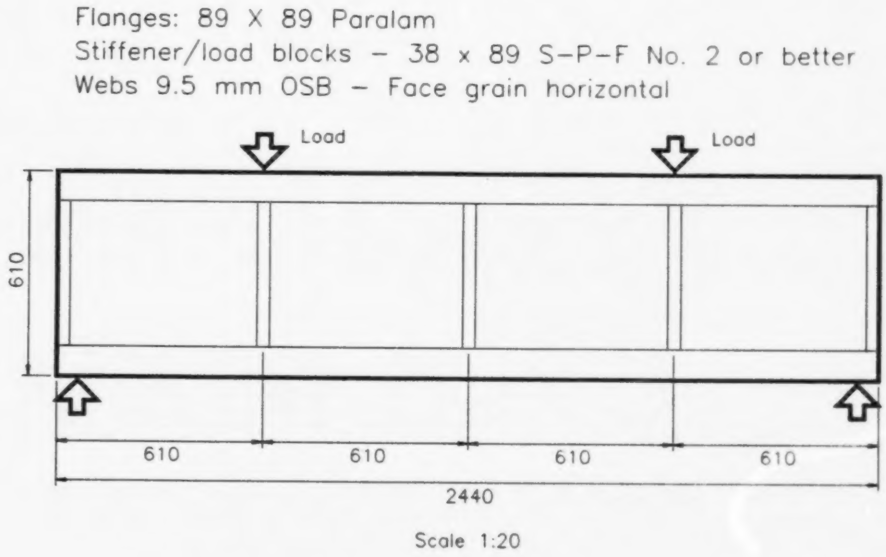

Flanges: 89 X 89 Paralam
Stiffener/load blocks – 38 x 89 S–P–F No. 2 or better
Webs 9.5 mm OSB – Face grain horizontal
Load
Load
610
610
610
610
610
2440
Scale 1:20

Figure 3.5 - Pilot test beam framing

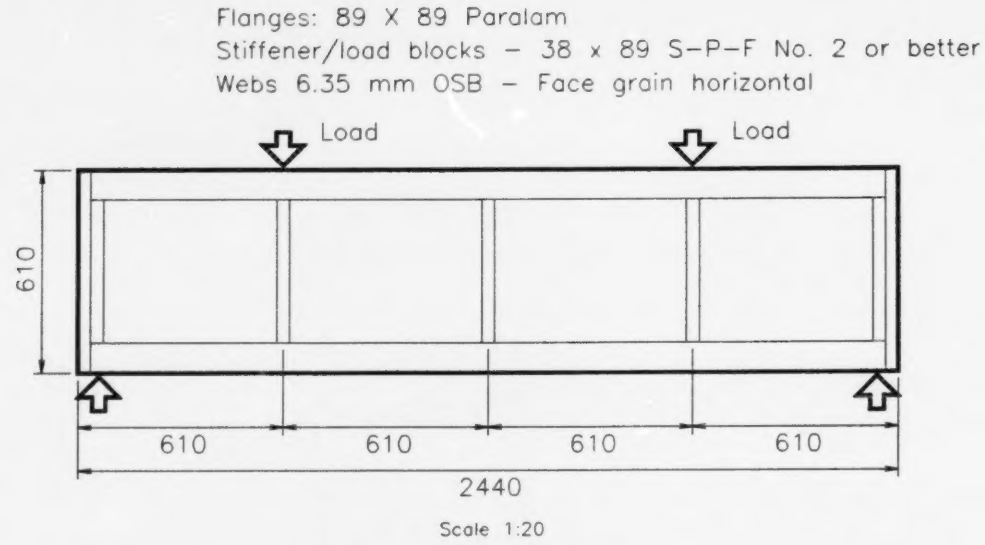

Flanges: 89 X 89 Paralam
Stiffener/load blocks – 38 x 89 S-P-F No. 2 or better
Webs 6.35 mm OSB – Face grain horizontal
Load
Load
610
610
610
610
610
2440
Scale 1:20

Figure 3.6 - Type A beam framing

The Type B beams (Figure 3.7) were very similar to the type A beams . The only differences between the two series were the location of the interior stiffener/load blocks and the point of load application, one-third span spacing, and the actual mean web thickness, 6.86 mm. Load was applied to the top flange 813 mm from the end of the beams.

The Type C beams (Figure 3.8) used the same stiffener/load block spacing as the Type A beams but had the web panel face grain running vertically with a mean web panel thickness of 6.04 mm. A double 38 x 89 stiffener was placed at mid-span to facilitate the web splice required by the 1220 mm panel width. Load was applied to the top flange 610 mm from the ends of the beams.

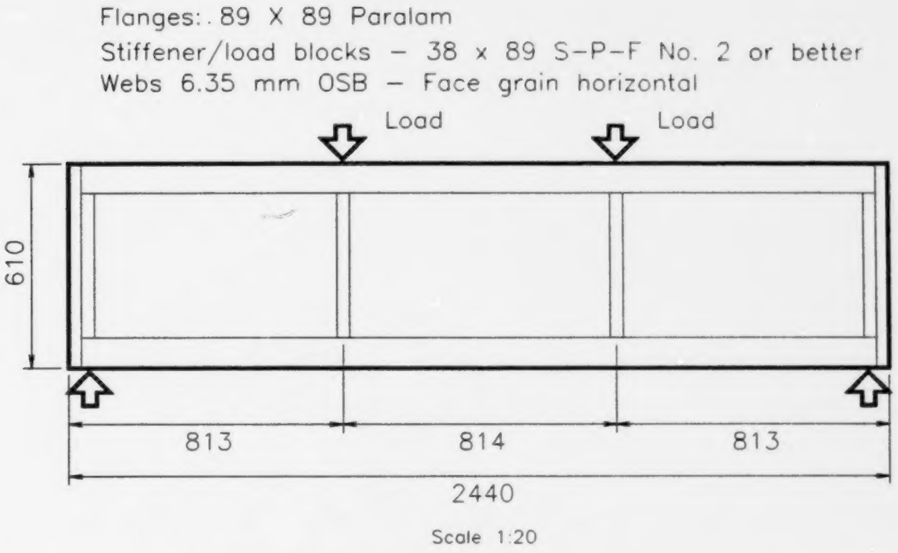

Flanges:. 89 X 89 Paralam
Stiffener/load blocks – 38 x 89 S-P-F No. 2 or better
Webs 6.35 mm OSB – Face grain horizontal
Load
Load
610
813
814
813
2440
Scale 1:20

Figure 3.7 - Type B beam framing

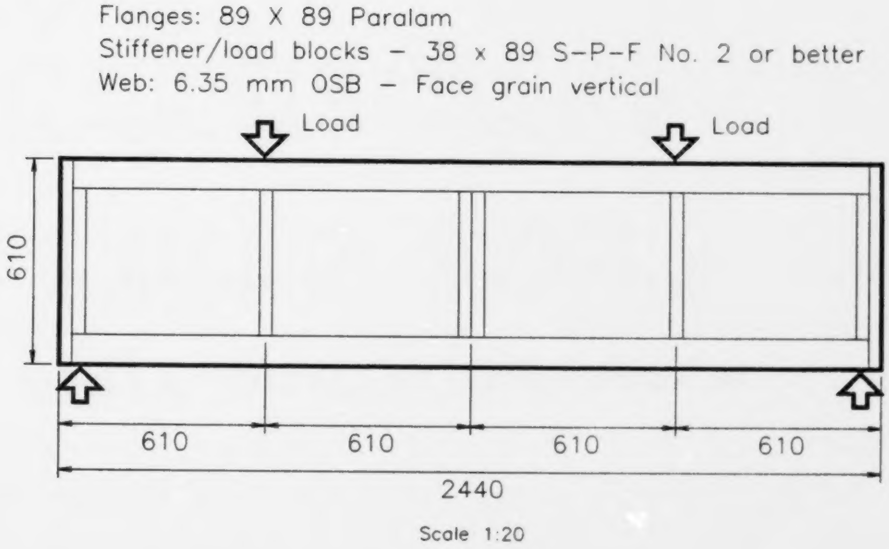

Flanges: 89 X 89 Paralam
Stiffener/load blocks – 38 x 89 S-P-F No. 2 or better
Web: 6.35 mm OSB – Face grain vertical
Load
Load
610
610
610
610
610
2440
Scale 1:20

Figure 3.8 - Type C beam framing

3.3 Test Set-up

Testing was performed at the I. F. Morrison Structural Engineering Laboratory, University of Alberta, using an MTS 6000 testing machine (Figures 3.9 and 3.10). A combination of rockers and rollers was used at the load and reaction points to ensure that no axial stresses or moments were induced by the supports or load blocks (Figure 3.12).

Lateral safety bracing required for support in the event the beam started to tip, as shown in Figure 3.11 used a horizontal L100 mm x 100 mm x 6 mm steel angle attached to the MTS machine, and a vertical L100 mm x 100 mm x 6 mm on the second side of the Pilot and Type A beams and obstructing some of the locations where out-of-plane web deflection was to have been measured. The lateral bracing was revised, as shown in Figure 3.11 for the Type B and C tests so that the deformation in all beam end panels could be measured.

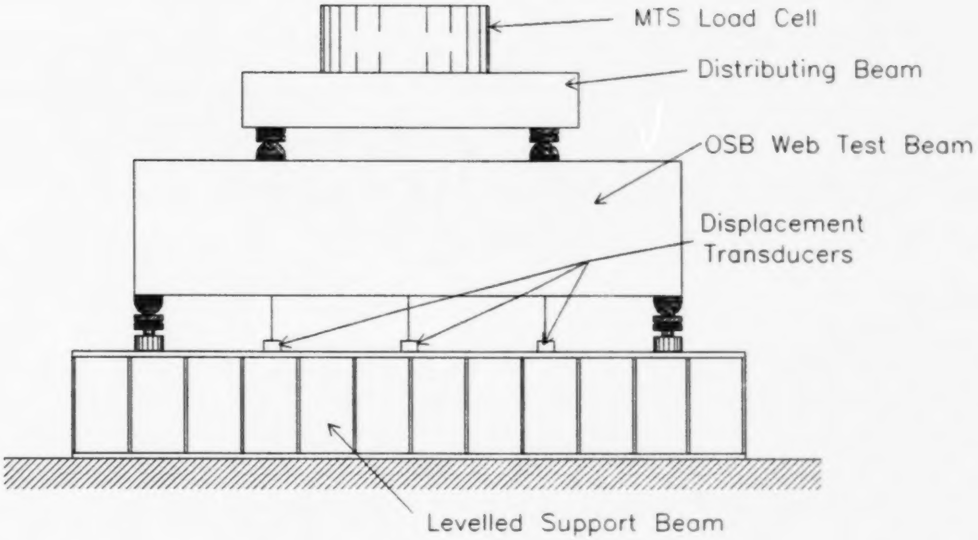

MTS Load Cell
Distributing Beam
OSB Web Test Beam
Displacement Transducers
Levelled Support Beam

Figure 3.9 - Test set-up showing MTS testing machine, distributing beam, load blocks, reaction blocks and levelled support beam

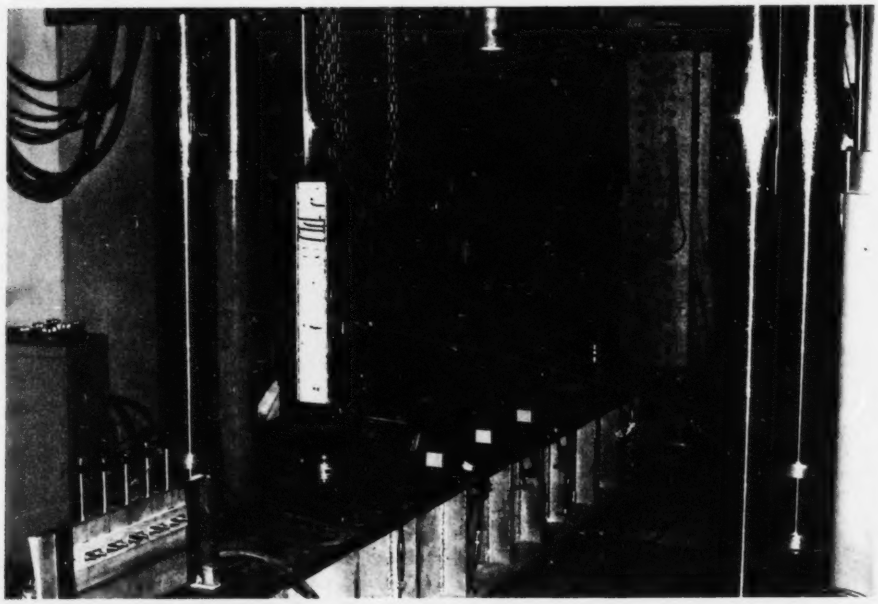


Figure 3.10 - Photograph of test set-up

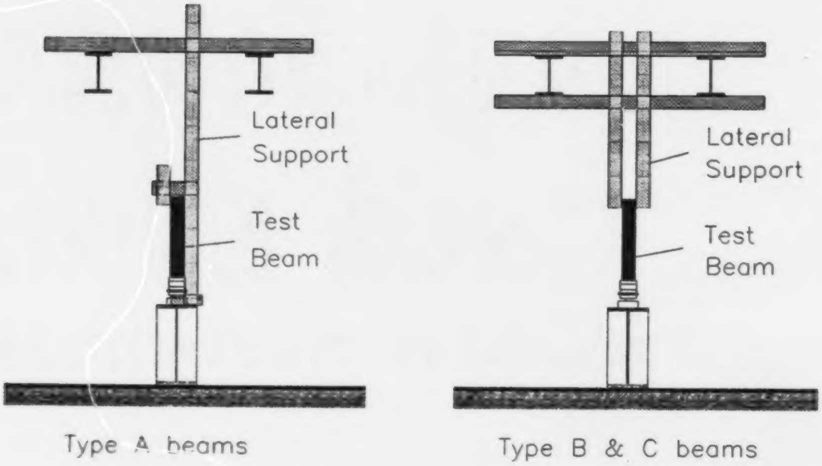
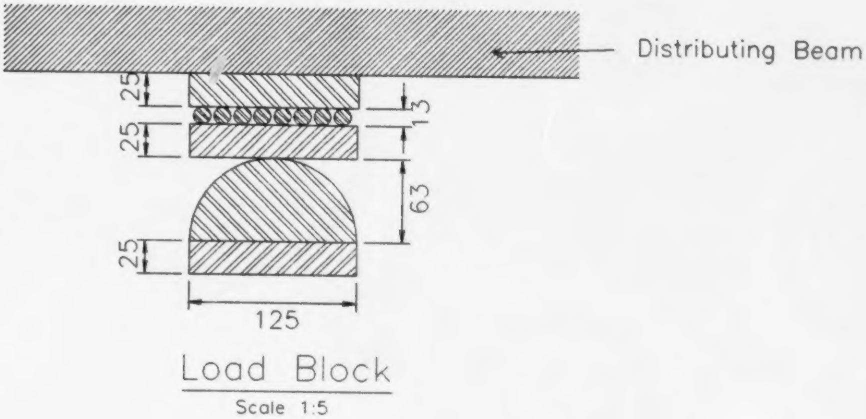

Lateral
Support
Test
Beam
Type A beams
Lateral
Support
Test
Beam
Type B & C beams

Figure 3.11 - Lateral safety bracing


Distributing Beam
25
25
25
13
63
125
Load Block
Scale 1:5

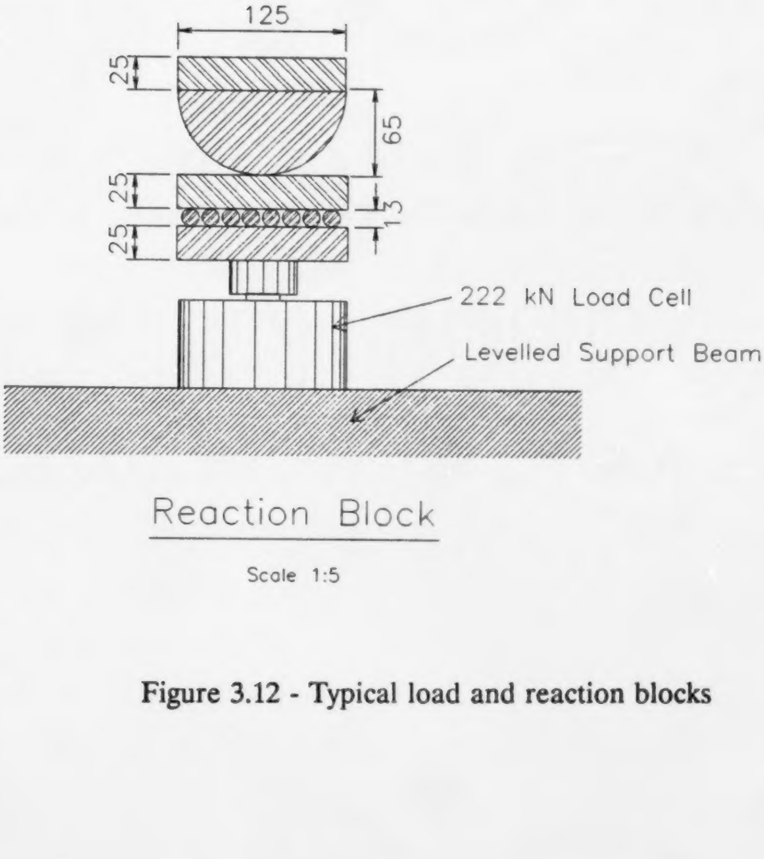

125
25
65
25
13
25
222 kN Load Cell
Levelled Support Beam
Reaction Block
Scale 1:5

Figure 3.12 - Typical load and reaction blocks

3.4 Instrumentation

Loads were measured using a load cell attached to the testing machine and 222 kN load cells at the beam supports (Figures 3.9, 3.10, 3.11). Web shear stress was measured using Demec gauges. Four pairs of steel disks with an indentation at the centre, Demec gauge points, were attached to the web around a common centre point aligned vertically, horizontally and at 45°. The distance between the two points in each pair of disks was measured using a dial gauge graduated in 0.0254 mm with no load and with various loads applied to determine the strain in the direction of each pair of disks. Three readings, horizontal, vertical and one 45° reading, are required to find the normal and shear strains for each group of points. The second 45° reading is used as a check. Using Mohr's circle, the principal normal and shear strains and the principal strain direction can be determined (Popov et al., 1978).

Four pairs of Demec gauge points were placed on the pilot test beam in 203 mm diameter circles at the centres of panels E and F (Figure 3.13). Pairs of Demec gauges points were also located on the sides of the webs at mid-span approximately 20 mm away from the top and bottom edges of the beam to measure the maximum normal strain in the flanges. The location of the distributing beam and the lack of clearance between the test beam and the distributing beam and between the test beam and the support beam made reading the Demec dial gauge impossible if the gauge points had been attached directly to the flanges. Two additional pairs of

Demec gauge points were attached to the flange and adjacent web at the end panel to measure the slippage between the flange and web. No attempt was made to measure flange strain or slippage in other test beams. Three groups of four pairs of Demec gauge points were attached using sealing wax to Panel E of Beam A-1 in three 50.4 mm (2") circles to measure the shear strain at above, below and at beam mid-height (Figure 3.14).

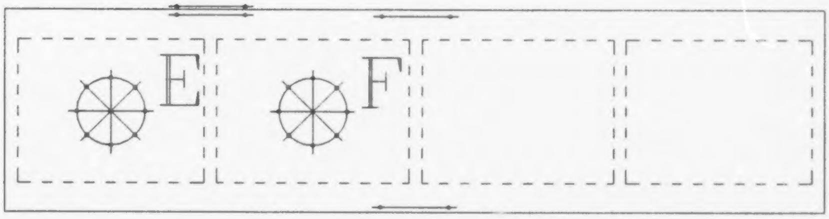


Figure 3.13 - Pilot test beam Demec gauge placement on Panels E and F

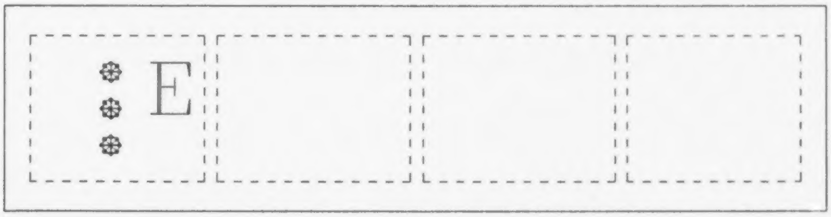
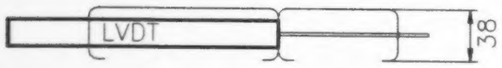


Figure 3.14 - Beam A-1, Demec gauge placement on Panel E

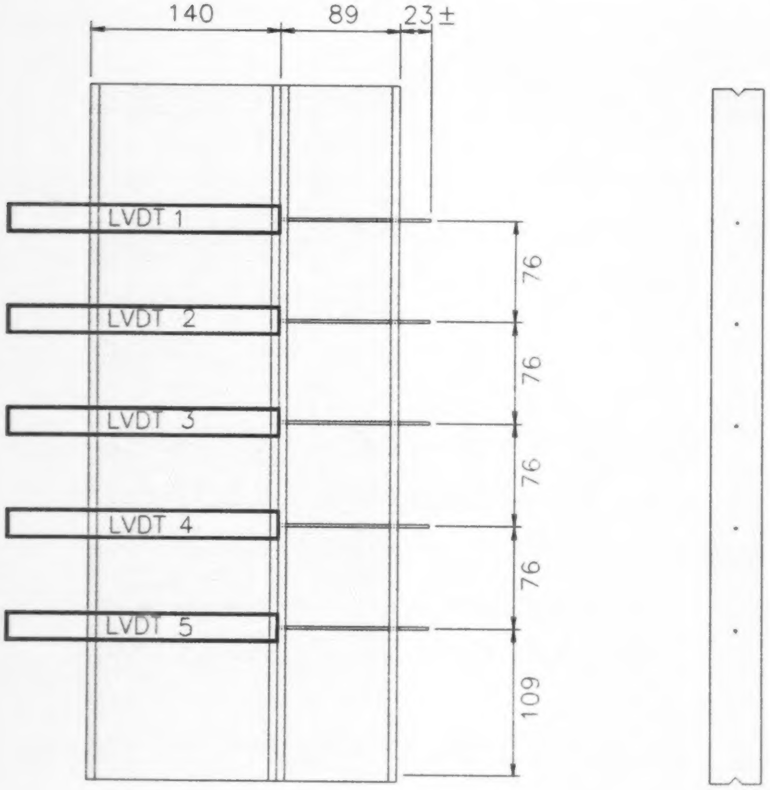
Out-of-plane web deflection was measured using linearly variable differential transformers (LVDT's). LVDT's transform an input voltage at a rate that is a linear function of the displacement of the LVDT plunger. A light gauge steel frame held an array of five LVDT's (Figure 3.15) approximately 76 mm apart to measure out-of-plane web deformation at various loads in the type A, B, and C beams (Figure (3.16, 3.17 and 3.18). Pencil lines on the end panels of the beams were used as a guide for proper placement of the LVDT frame. Fifty mm long nails were driven into the bottom flange to ensure that the LVDT frame was properly placed vertically and that the bottom of the frame was at the correct location horizontally. As a result of obstructions due to bracing, not all the readings on the second side of the Type A beams were taken. The letters or numbers at the top of each column of LVDT readings in Figures 3.16, 3.17 and 3.18 are used to identify the location of readings and correspond to the letters or numbers beside the rows of out-of-plane web displacements in Appendix B.

Bottom flange vertical deflection was measured at mid span and at the points where loads were applied, as shown in Figure 3.9. Mid span deflection in all tests was measured using a displacement transducer. In the pilot and Type A tests, load point deflection was measured using LVDT's. The load point deflection was measured using displacement transducers in the Type B and Type C beam tests.



Top View

Scale 1:5


140
89
23±
LVDT 1
LVDT 2
LVDT 3
LVDT 4
LVDT 5
76
76
76
76
109

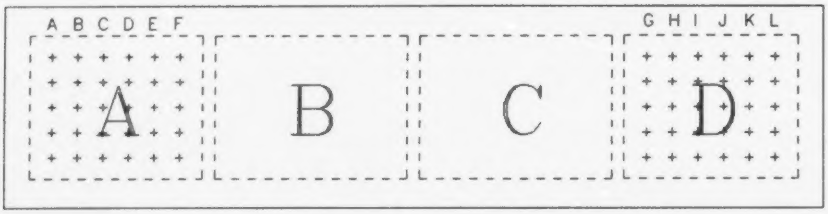
Side View

Scale 1:5

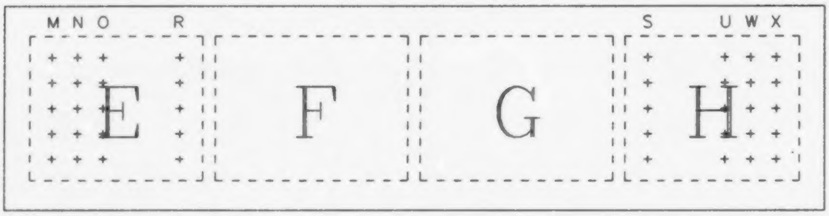
Edge View

Scale 1:5

Figure 3.15 - Light gauge steel frame and LVDT's for measuring out-of-plane web deformation

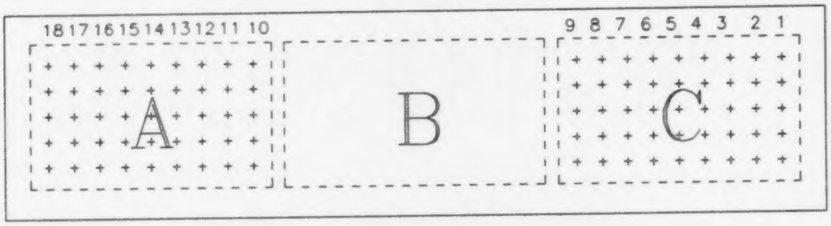

A B C D E F
G H I J K L
A
B
C
D

Type A Beams

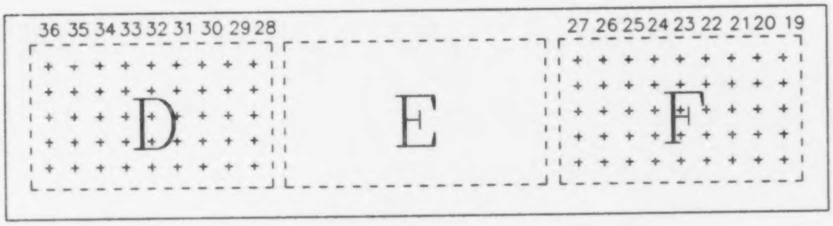

M N O R
S U W X
E
F
G
H

Type A Beams

Figure 3.16 - Panel identification for preliminary and Type A beams. Location of out-of-plane web displacement measurements, Type A beams

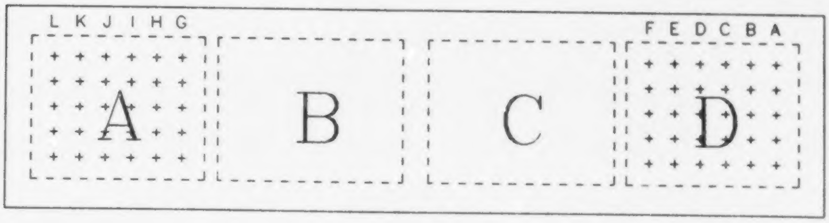

18 17 16 15 14 13 12 11 10
9 8 7 6 5 4 3 2 1
A
B
C

Type B Beams

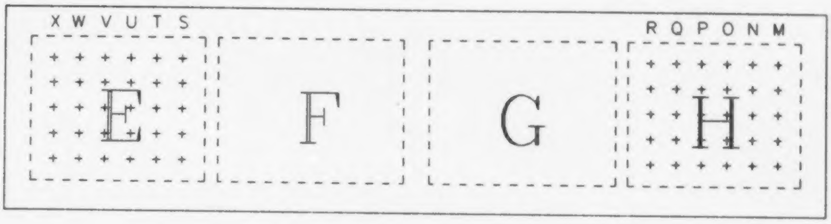

36 35 34 33 32 31 30 29 28
27 26 25 24 23 22 21 20 19
D
E
F

Type B Beams

Figure 3.17 - Location of out-of-plane web displacement measurements and panel identification, Type B beams



Type C Beams



Type C Beams

Figure 3.18 - Location of out-of-plane web displacement measurements and panel identification, Type C beams

The output from the load cells, transducers and LVDT's was sent through a Fluke 2401A signal conditioner and stored in an IBM PC computer in ASCII format using Lotus 1-2-3. The data were later imported to spreadsheets for analysis.

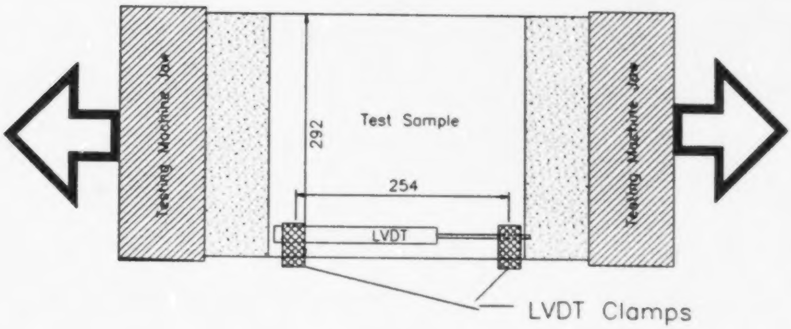
Load was applied to each of the beams by the MTS testing machine, as shown in Figure 3.9. The testing machine stroke was controlled rather than controlling the load to avoid changes in deflection and web strain while the various web strain and out-of-plane deflection measurements were made. The load was applied at various increments, 5 kN between deflection readings and 10 kN or 20 kN between measurements of out-of-plane web deflection. All beams were tested to failure.

3.5 Materials Testing

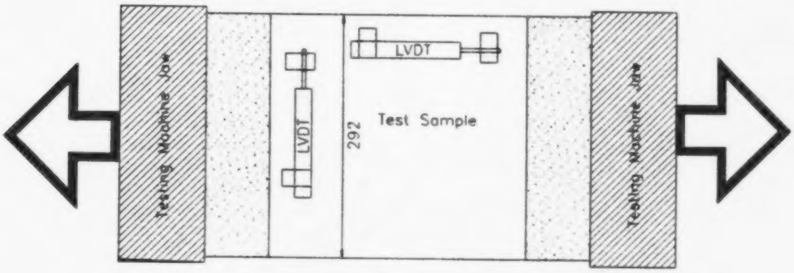
Following the beam tests, all beams were disassembled so that the web and flange materials could be tested. Moisture content of the web materials was determined approximately ten weeks after completion of the preliminary test and approximately six weeks after the test of the Type A beams. Following the Type B and C beam tests, the moisture content was measured the day after completion of the beam tests.

The elastic modulus and tensile strength of the web panels were determined by tension testing at the Alberta Research Council, using a Metriguard 1410 testing machine with an LVDT parallel to the face grain. Testing was performed in accordance with ASTM standard D 198 (1985) with the following exceptions. Speed of testing was not controlled in terms of linear head motion, however the elapsed time between initial load application and failure was 2 to 3 minutes. One strain measurement device was used rather than two. The specimen length was approximately equal to the greater cross-sectional dimension.

Some of the panels from the Type B and C beams were tested using LVDT's parallel and perpendicular to the face grain so that the Poisson's ratio and shear modulus could be determined in addition to the elastic modulus and tensile strength (Figure 3.19). The length of the LVDT's used to measure longitudinal and transverse changes in length required that one of the LVDT's be located close to the edge of


Testing Machine Jaw
292
Test Sample
254
LVDT
Testing Machine Jaw
LVDT Clamps

Modulus of Elasticity Test


Testing Machine Jaw
LVDT
LVDT
292
Test Sample
Testing Machine Jaw

Modulus of Elasiticty, Poisson's Ratio, Shear Modulus Test

Figure 3.19 - Web panel tension test apparatus

the test panel (Figure 3.19). The proximity of the transverse LVDT to the panel splices which were three times the thickness of the pieces being tested appears to have resulted in measured transverse strain below the expected transverse strain at the middle of the test panel. As a result of the inaccurate transverse strain measurement, the calculated Poisson's ratio is probably incorrect. Using shorter LVDT's closer to the centre of the test panels would have eliminated this problem.

The Metriguard 1410 testing machine provided a plot of force vs. longitudinal deflection as measured by the LVDT, longitudinal and transverse deflection if two LVDT's were used, with a maximum load of about 22 kN plotted. Using the linear portion of the plot, the force was divided by the cross-sectional area of the sample to determine the stress. Strain was determined by dividing the linear portion of the deflection by the original length of the LVDT. Dividing the stress by the strain gives the elastic modulus. The maximum load applied to the sample was recorded by the testing machine. This load was divided by the sample cross-sectional area to determine the tensile strength of each test sample.

Flange and stiffener materials were compression tested at the I. F. Morrison Structural Laboratory using an MTS 1000 testing machine and 50.4 mm Demec gauges, Figure 3.20, to determine the elastic modulus parallel to the grain. Testing was performed in accordance with ASTM standard D 198 (1985) with the following exceptions. One pair of gage points were used on each sample rather than two. The speed of testing was not controlled in terms of head motion, each test lasted approximately 5 minutes. Samples were not loaded to the point of failure as only the elastic modulus was required. The information obtained from these tests was required for the plane frame model therefore the effective elastic modulus of the combined S-P-F/OSB section was determined by testing.

Stiffeners were tested with and without web material attached. The stiffeners were subjected to a maximum compressive load of 50 kN in 10 kN increments.

Double 38 mm x 89 mm stiffener/load blocks were loaded to 100 kN compression parallel to the stiffener/load block grain in 20 kN increments. The 89 mm x 89 mm 'Paralam' flange material was subjected to a maximum load of 200 kN parallel to the grain in increments of 20 kN. Testing was performed in accordance with ASTM standard D 198 with the exceptions noted for the flange material. Following testing of the beam components, the moisture content of the samples was determined.

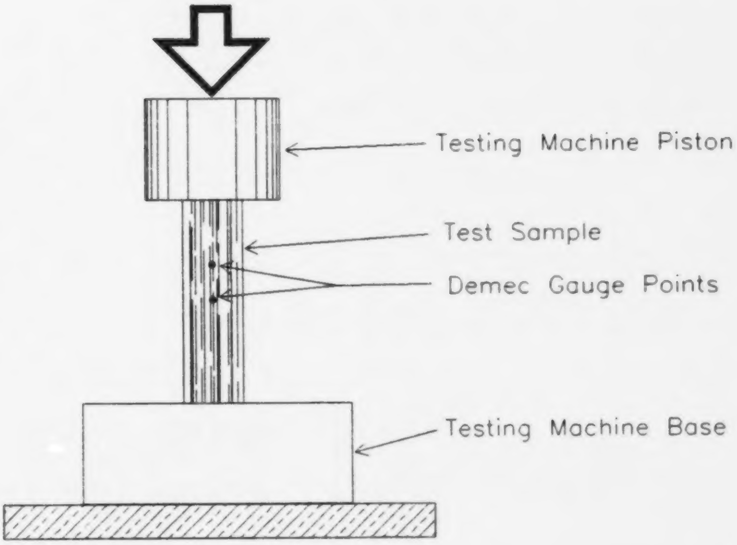

Testing Machine Piston
Test Sample
Demec Gauge Points
Testing Machine Base

Figure 3.20 - Flange and stiffener/load block compression test apparatus

4 Test Results

4.1 Introduction

The information presented in this chapter summarizes the test data which are included in the appendices. Material test results are presented in tabular form. Load-deflection data for the beams are presented as graphs with maximum values summarized in tabular form.

4.2 Materials Tests

The results of tension tests of the web panels are summarized in Table 4.1. The web material used in these tests was taken from the interior beam panels which were not subjected to shear stresses during testing. The Type B beam material which was tested at 45° to the face grain was taken from extra panels that were not used in test beams. In addition to the tensile strength and modulus of elasticity, the Type B and C beam panels were also tested to determine Poisson's Ratio (Table 4.2).

Stiffener/load block material was tested in compression to determine the elastic modulus parallel to the grain with and without web material attached to the framing members. Flange material was also tested in compression to determine the elastic modulus. The results of these tests are summarized in Table 4.3.

Table 4.1 Web panel material moisture content, thickness, tensile strength and elastic modulus

Beam Type	MC % Dry Basis	t (mm)	Tensile Strength (MPa)			Tension Elastic Modulus (MPa)		
			0°*	45°	90°	0°	45°	90°
Pilot	5.8	10.22	16.7 [1.6% 2]**		11.4 [3.4% 2]	5140 [8.0% 2]		4480 [78.8% 2]
A	5.1	6.92	16.9 [7.9% 5]		17.5 [21.4% 6]	3780 [15.4% 6]		4040 [24.8% 6]
B	3.1	6.78	18.5 [6.8% +6]	14.7 [11.4% 4]	14.0 [11.9% 5]	5430 [22.2% 6]	5560 [13.8% 4]	5170 [13.1% 6]
C	3.5	6.04	16.8 [15.6% 6]		8.8 [12.4% 4]	5530 [28.8% 6]		3230 [21.4% 5]

* Angles indicate angle between face grain orientation and direction of applied load.

** Coefficient of variation and number of observations are shown in brackets.

As mentioned previously, the materials testing program did not result in a reliable measurement of transverse strain to calculate the shear modulus in the plane of the panel. The mean elastic modulus, parallel and perpendicular to the face grain, and an assumed uniform Poisson's Ratio of 0.3 were used to calculate the shear modulus, discussed later. The assumed Poisson's Ratio of 0.3 is recommended as an average for wood composites by Bodig and Jayne (1982).

Table 4.2 Type B and C beam web material Poisson's ratio

Beam	Poisson's Ratio		
	0°*	45°	90°
B	0.164 [38.6%, 2]**	0.360 [12.3%, 4]	0.135 [107.5%, 2]
C	0.436 [0.3%, 2]		0.228 20.7%, 2

[*] Angles indicate angle between face grain direction and direction of applied load.

[**] Coefficient of Variation and number of observations are shown in brackets.

Table 4.3 Flange and stiffener/load block elastic modulus

Material	Elastic Modulus (MPa)
Flange	10300 [14.2%, 3]*
Stiffener with Web	6520 [53.2%, 8]

[*] Coefficient of Variation and number of observations are shown in brackets.

4.3 Box Beam Tests

The mean values for maximum load, horizontal deflection of web panels, vertical deflection at point of load application and vertical deflection at mid-span are summarized in Table 4.4.

Table 4.4 Summary of ultimate load, out-of-plane web and beam deflection test results

Beam	Mean Maximum Load (kN)	Mean Maximum Deflection (mm)		
		Web	Vertical	
		Out-of-Plane	Load Point	Mid-Span
Pilot	140		3.65	4.03
A	133.8	14.68	6.15	6.65
B	119.2	14.23	6.77	7.42
C	107.2	11.14	4.77	5.39

4.3.1 Pilot Test Beam

The initial application of load to the pilot test beam used a single load point at the centre of the beam. The applied load did not have any visible effect on the beam except vertical deflection. Due to the thickness of the web material, no web buckling was observed. As the load approached 130 kN, the flange and web material appeared to be close to failure due to compression perpendicular to the grain at the point of load application before the webs failed in shear. The bearing stresses compressed the flange material at a faster rate than the adjacent web material, indicating that the web had a higher modulus of elasticity in the direction of the load than the flange. Subsequent tests confirmed that the modulus of elasticity of the paralam flanges perpendicular to the grain is lower than that of OSB perpendicular to the face grain.

In order to reduce the bearing stress at the point of load application, the load was applied at the 1/4 span points. The reduced bearing stress at the point of load application eliminated the problem of flange compression at that point and allowed the application of higher loads. The weak point in the beams now became the flange at the supports. The flange material again deformed at a faster rate than the webs and resulted in local failure of the webs at the reaction blocks.

Neither centre span loading nor quarter span loading resulted in visible lateral deformation of the web due to shear loads. The web strains measured using Demec gauges indicated that the maximum principal tensile stress direction was approximately from the upper outer corner to the lower inner corner of the end web panels, that is parallel to the tension diagonal. The maximum load reached was 140 kN.

4.3.2 Type A Beams

With thinner webs than the pilot test beam, the type A beam webs which were loaded in shear buckled. Pre-buckling deflection in some of the web panels was erratic, deflection increased and decreased with no apparent relationship between load and deflection. This erratic behaviour can be attributed to initial curvature, imperfections in the web panels and the initial mode of buckling. In some panels, out-of-plane web panel deflection took the form of a full wave sine curve at lower loads. As the load increased, one side of the sine curve grew until the out-of-plane deformation took the form of a half wave sine curve. The out-of-plane deflection contours were roughly elliptically shaped with the major axis oriented along the tension diagonal of the end web panels (Figure 4.1). The maximum lateral web deformation ranged from 13.49 mm to 15.70 mm and averaged 14.48 mm outward. Several panels, however, deformed inward. In one panel, the initial inward deformation reversed to become outward deformation as the panel approached failure. A section through the deformed panels had a sinusoidal shape with smooth curves from the zero slope where the panels were attached to flanges and stiffeners.

The web panels on both sides of one end of each beam failed simultaneously due to diagonal tension and buckling with failure planes along and perpendicular to the tension diagonal (Figures 4.2 and 4.3). Ticking noises were heard from about 80 kN until failure. Failure occurred with a loud report when the total load reached 128 to 139 kN. Integrating the shear stress across the beam cross-section shows that the webs, in this particular beam configuration, resist approximately 5/6 of the total shear force. Therefore the ultimate shear force resisted by each web panel was in the 27 to 29 kN per panel range and the flanges resisted approximately 11.6 kN shear force. The panels at the end of the beam that did not fail had approximately the same out-of-plane deflection as the panels that failed, however the panels that did not fail had no visible cracks or other visible indication of reduced capacity. Measurement of strains in the Beam A-1 panels loaded in shear was attempted but the results were inconsistent due to buckling. Out-of-plane web deflection increased slightly up to a point and then began to increase rapidly. The rapid out-of-plane web deflection was linearly related to load until failure (Figure 4.4).

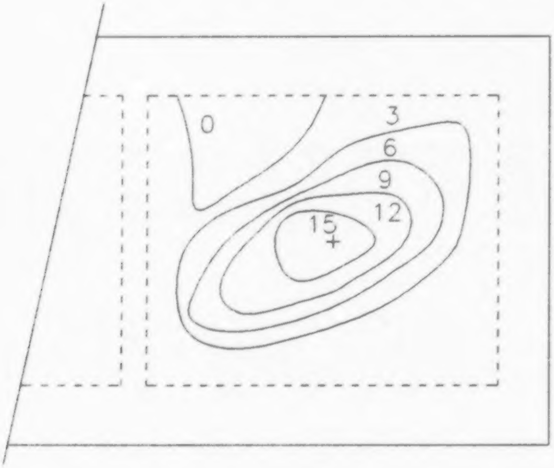
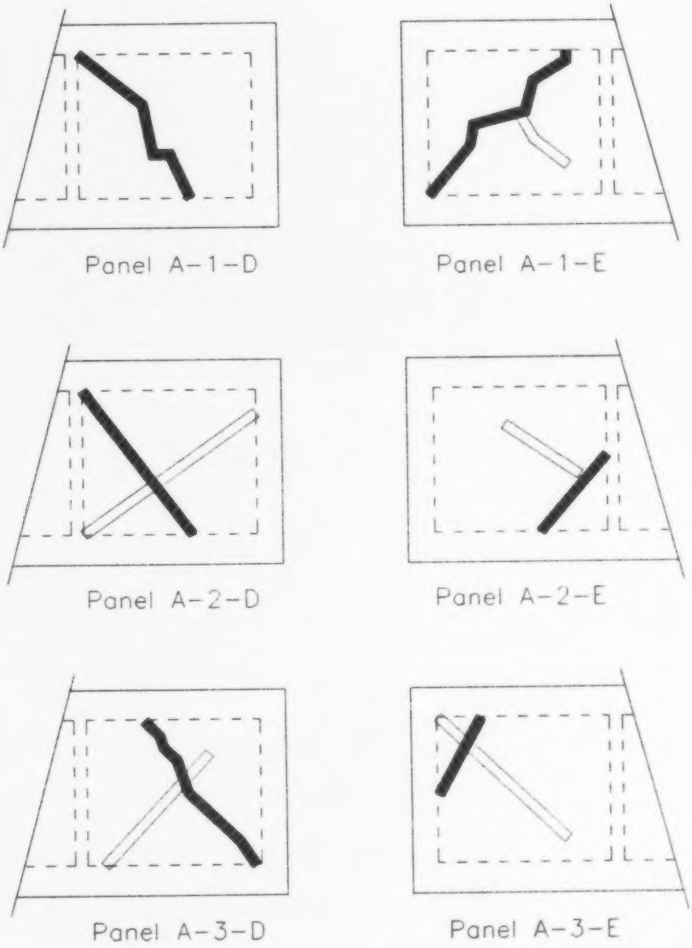


Figure 4.1 - Panel A-1-D, out-of-plane deformation contours (mm)



Panel A-1-D

Panel A-1-E

Panel A-2-D

Panel A-2-E

Panel A-3-D

Panel A-3-E

Note: Solid line indicates panel fracture. Open lines indicate buckling.

Figure 4.2 - Type A beam failure patterns.

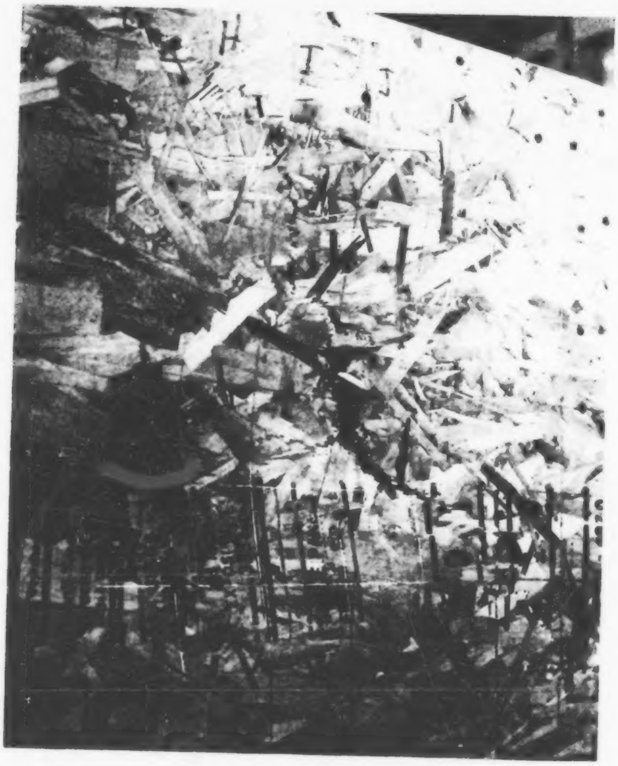


Figure 4.3 - Panel A-1-D diagonal tension failure

Elastic vertical deflection was very close to linear until the beams were at approximately 80% of the ultimate load. As the load approached its maximum, the slope of the load-deflection curve began to decrease (Figures 4.5, 4.6 and 4.7).

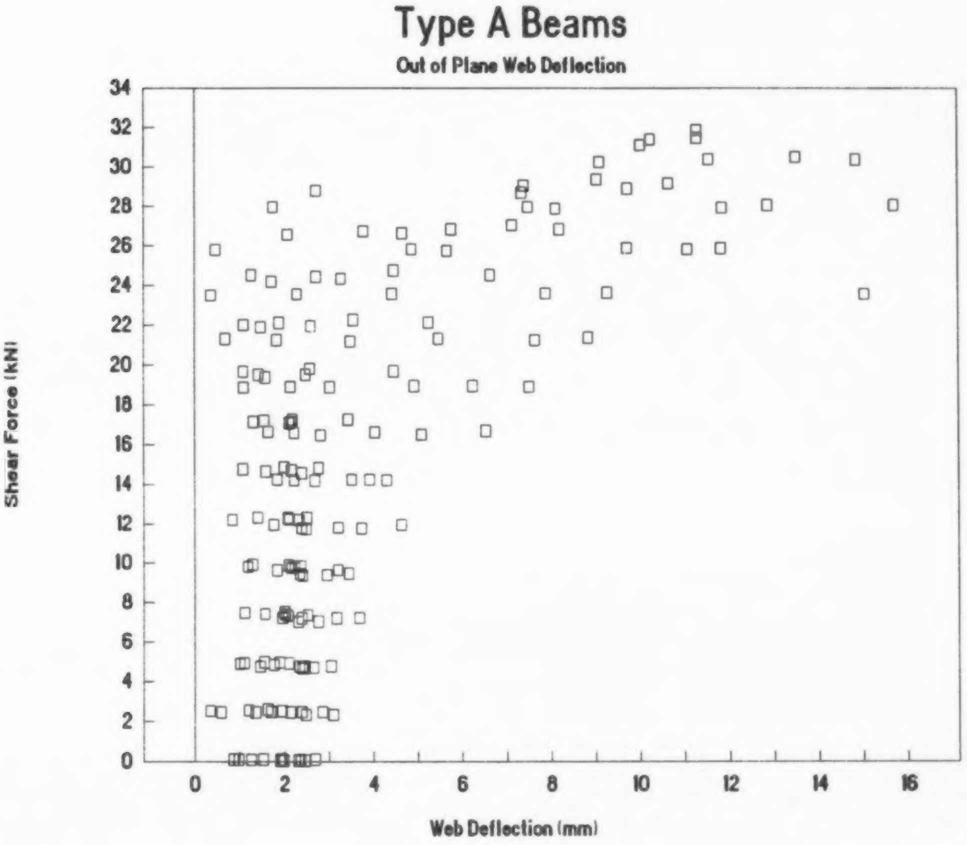


Figure 4.4 - Type A beam out-of-plane web deflection vs. load

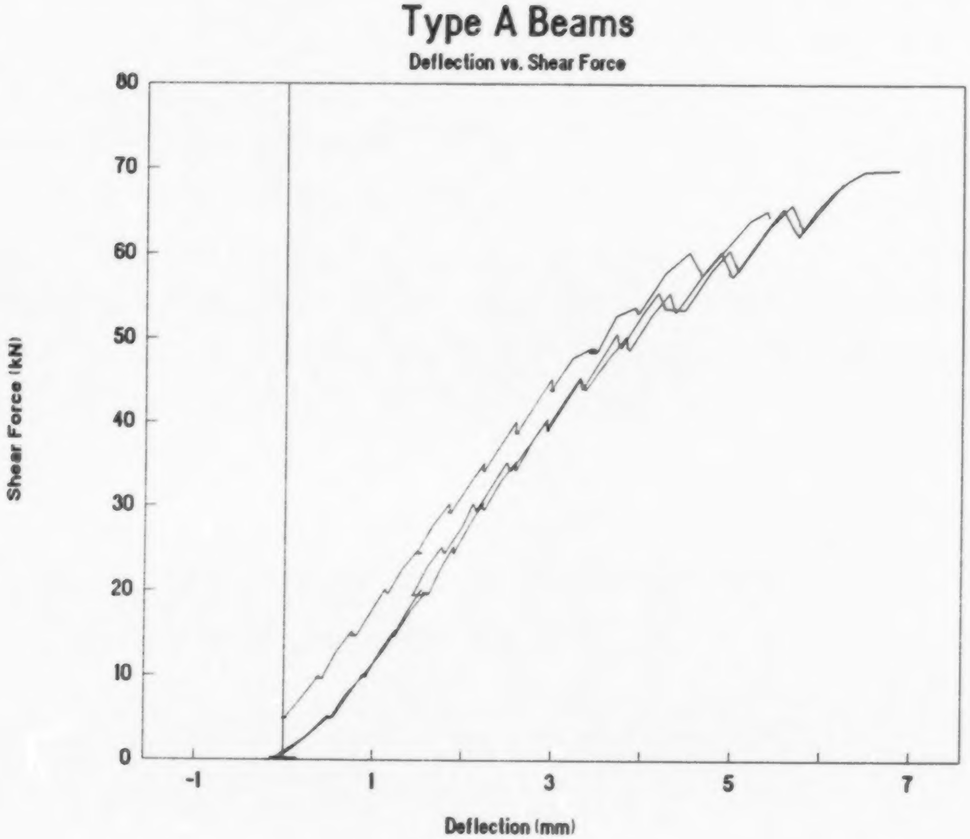


Figure 4.5 - Type A beams load point deflection vs. shear force between panels C/F and D/E

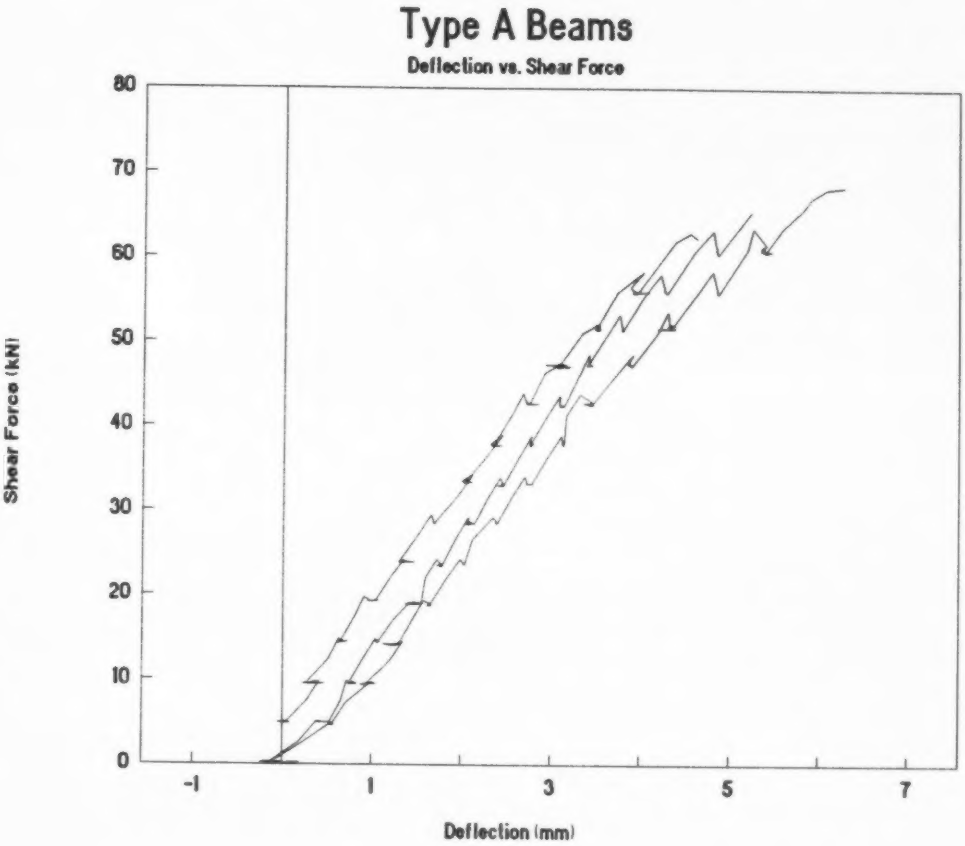


Figure 4.6 - Type A beams load point deflection vs. shear force between panels A/H and B/G

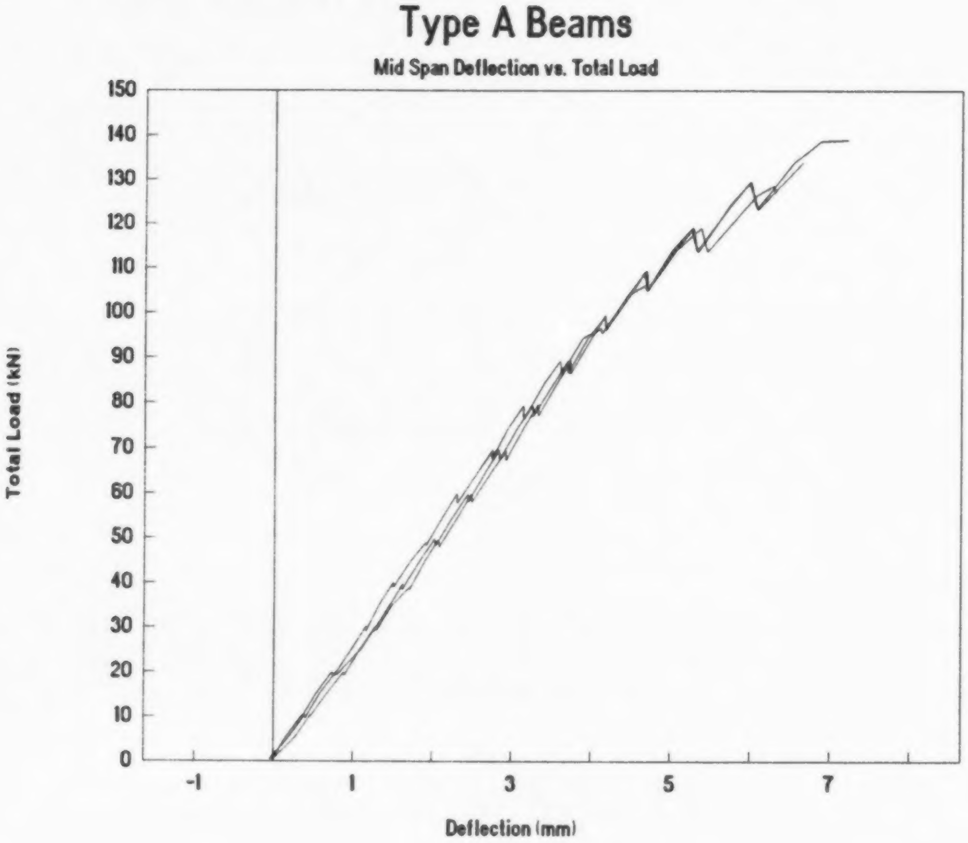


Figure 4.7 - Type A beams mid span deflection vs. total load

4.3.3 Type B Beams

The Type B beams had longer web panels and different web elastic moduli than the Type A beams. The deformation pattern in the Type B beams was very similar to that observed in the Type A beams. An elliptical compound curve (Figure 4.8) developed along the tension diagonal with a maximum lateral deflection of 13.72 mm to 14.96 mm with an average of 14.33 mm. As was seen in the type A beams, the slope of the deflected web was zero relative to the framing members around the perimeter of the panels loaded in shear. The maximum shear loads ranged between 23 kN and 26 kN per web panel with a mean of 25 kN with 3.8 kN to 6.8 kN shear force resisted by the flanges.

Unlike the type A beams, the type B beams failed due to diagonal tension alone. Few cracks parallel to the tension diagonal or other indications of buckling failure were observed (Figure 4.9). Out-of-plane web deflection vs. shear force per panel is shown in Figure 4.10.

The relationships between load and out-of-plane deformation and vertical deflection were similar to those observed in the Type A beams (Figures 4.11, 4.12 and 4.13).

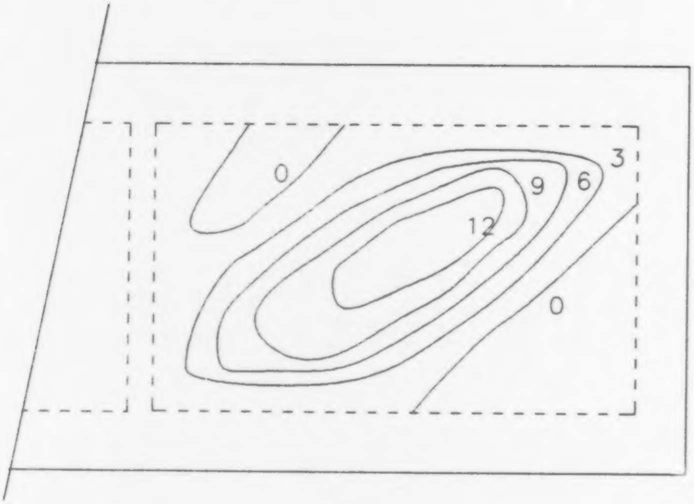
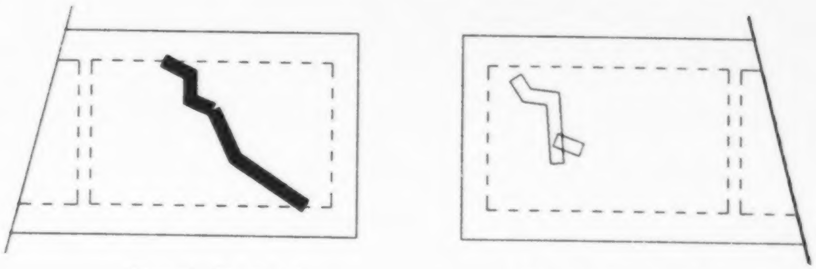
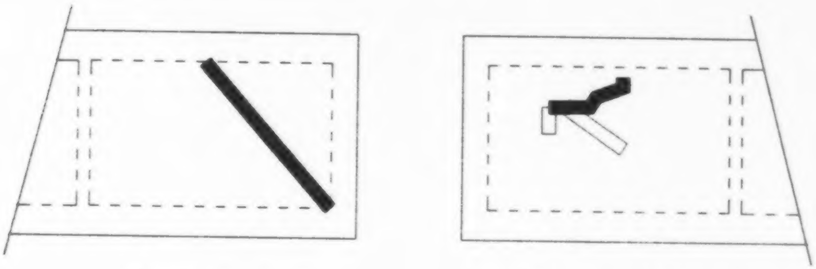


Figure 4.8 - Panel B-2-A, out-of-plane web deflection contours



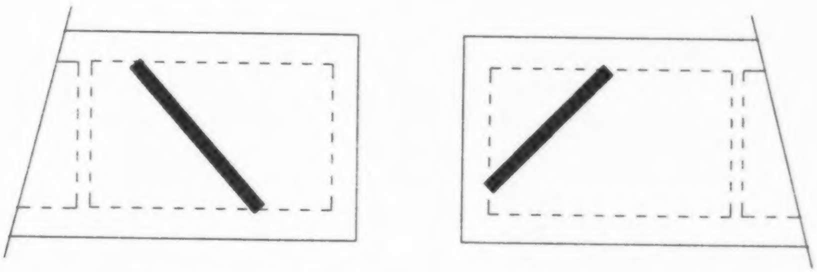
Panel B-1-C

Panel B-1-D



Panel B-2-F

Panel B-2-A



Panel B-3-C

Panel B-3-D

Note: Solid lines indicate panel fracture. Open lines indicate buckling.

Figure 4.9 - Type B beam failure patterns.

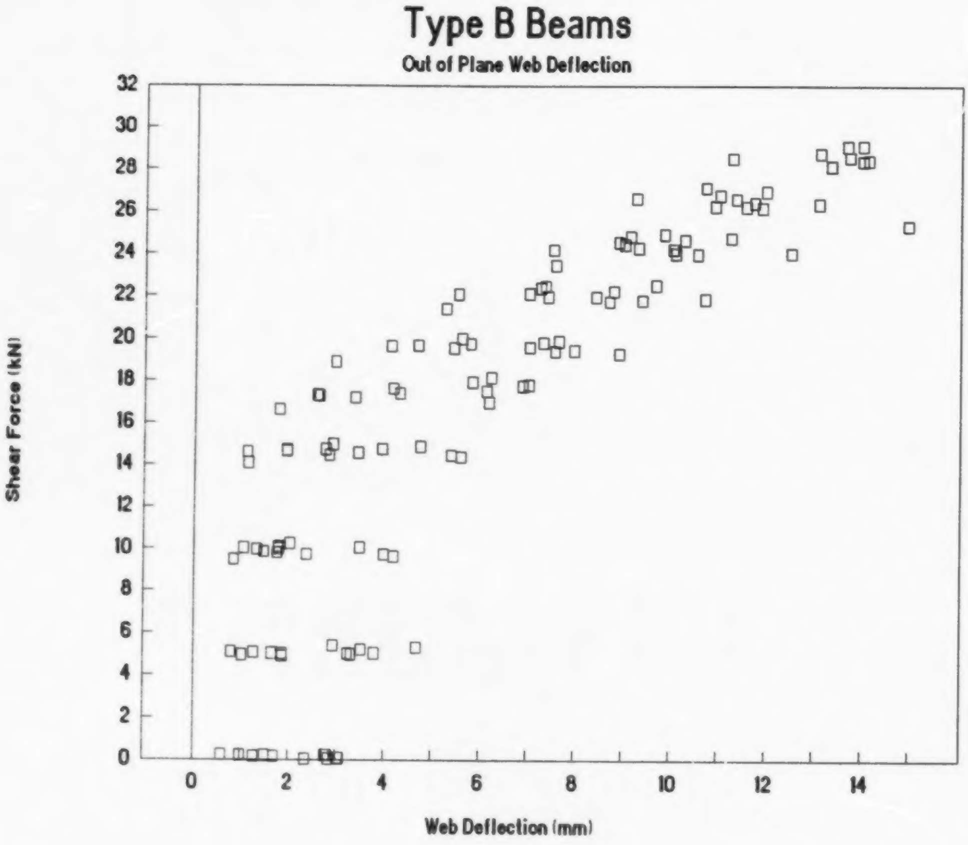


Figure 4.10 - Type B beams, out-of-plane web deflection vs. load

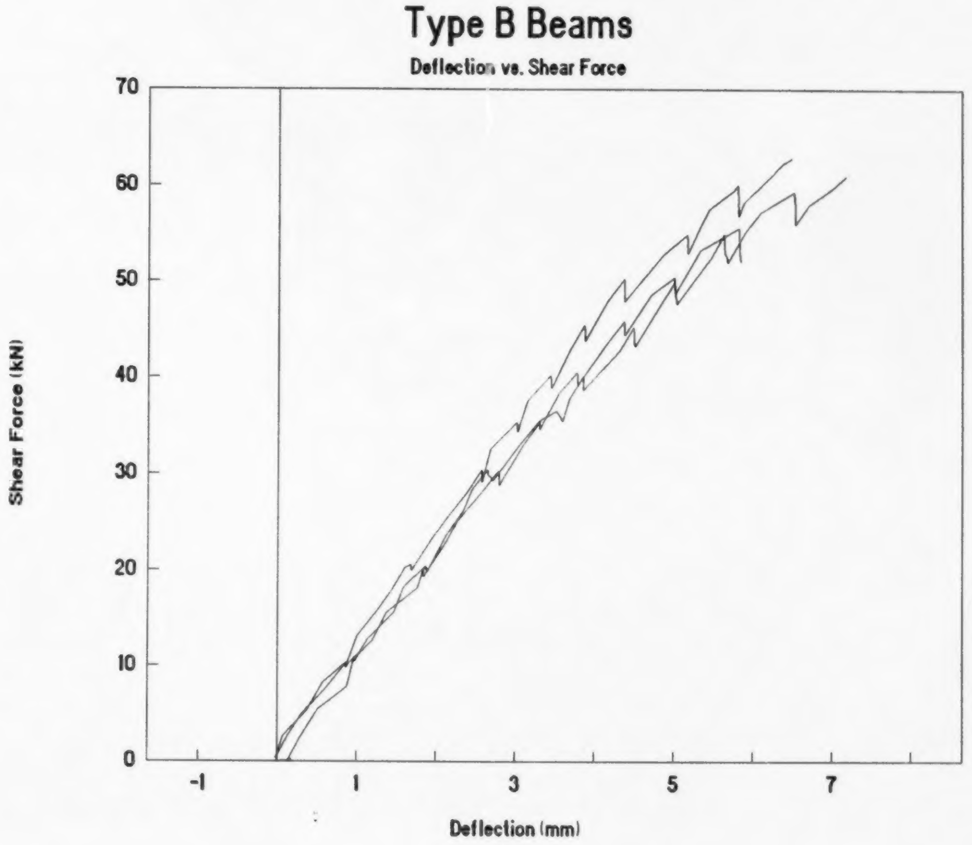


Figure 4.11 - Type B beams, load point deflection vs. shear force between panels B/E and C/F

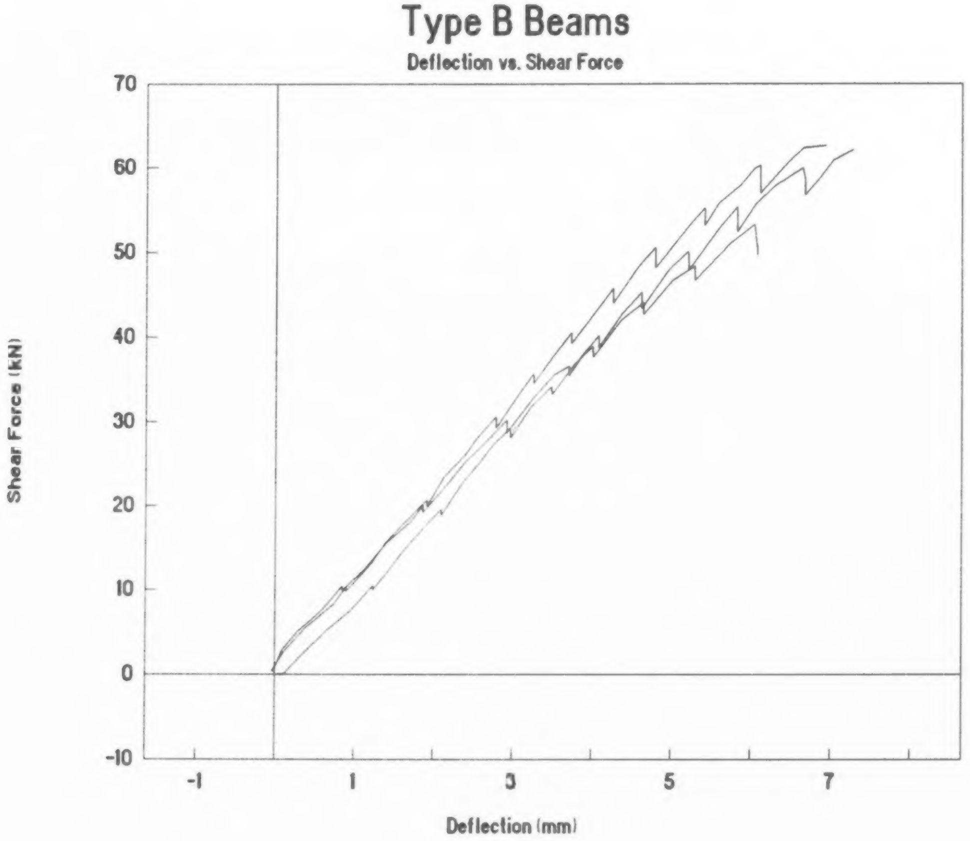


Figure 4.12 - Type B beams, Load point deflection vs. shear force between panels B/E and A/D

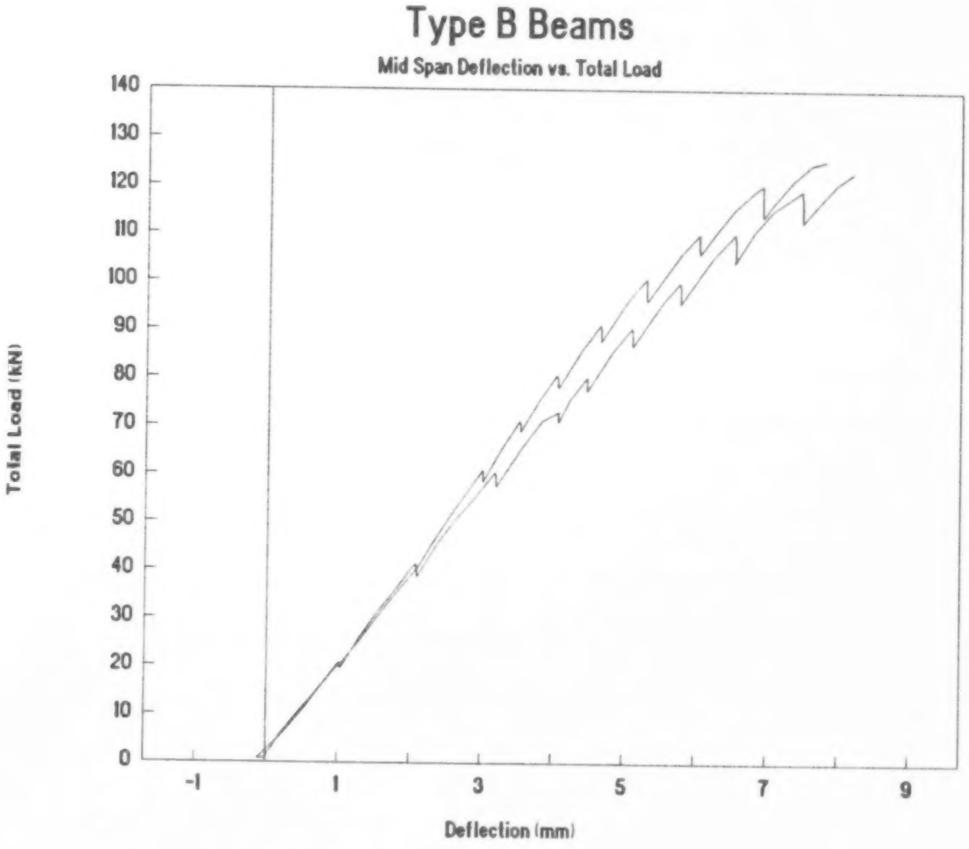


Figure 4.13 - Type B beams mid span deflection vs. total load

4.3.4 Type C Beams

The Type C Beams had the same panel dimensions as the Type A beams but with the face grain perpendicular to the span and had web panels with different mechanical properties. The deformation pattern and mode of failure were very similar to the Type A beams, Figures 4.13, 4.14 and 4.15. The out-of-plane web deflection ranged from 10.02 mm to 12.13 mm at maximum load with an average of 11.14 mm. Figure 4.13 shows the full wave deformation pattern that was recorded for Panel D of beam C-2. This panel did not exhibit the usual failure pattern. Figure 4.14 shows the usual pre-failure half wave pattern and was the panel that actually failed. The most significant differences between the Type A and C beams were the failure load and the shifting of the out-of-plane deformation axis toward the vertical direction. Maximum panel shear loads varied from 21 kN to 23 kN and had a mean value of 22 kN for the Type C beams.

The out-of-plane deformation and vertical deflection followed the same pattern as with the Type A and B beams (Figures 4.16, 4.17, 4.18 and 4.19).

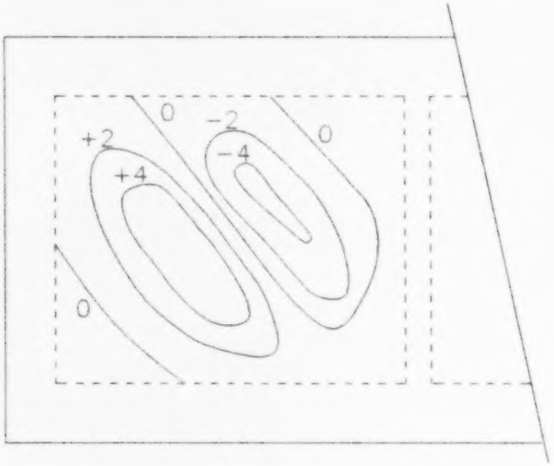


Figure 4.14 - Panel C-2-D full wave deformation contours

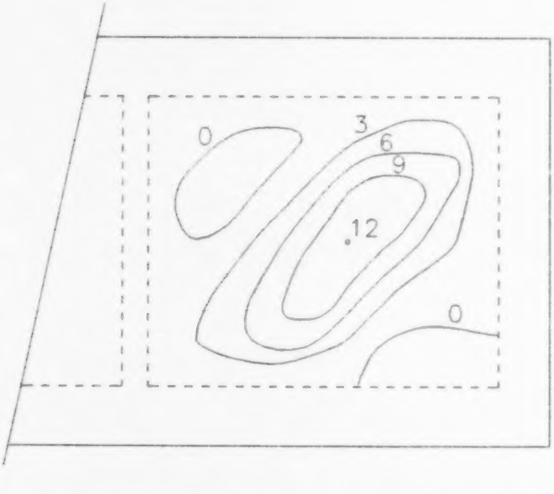
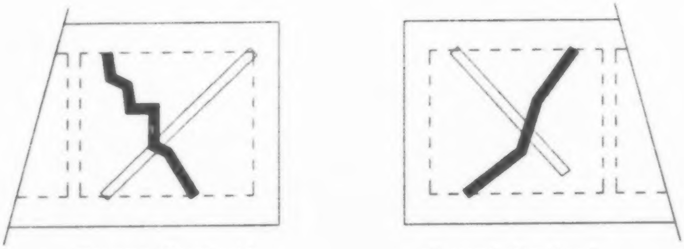
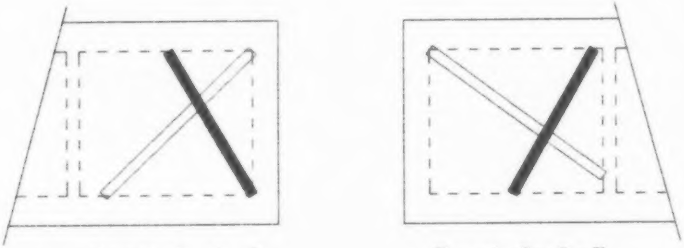


Figure 4.15 - Panel C-2-A out-of-plane web deflection contours



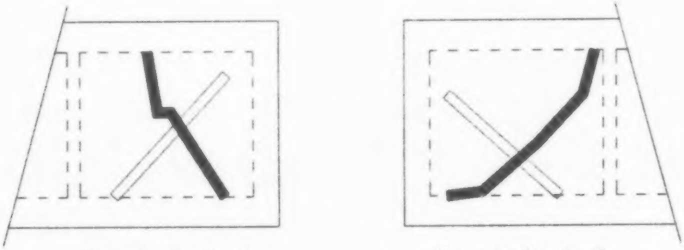
Panel C-1-H

Panel C-1-A



Panel C-2-D

Panel C-2-E



Panel C-3-D

Panel C-3-E

Note: Solid lines indicate panel fracture. Open lines indicate buckling.

Figure 4.16 - Type C beam failure patterns.

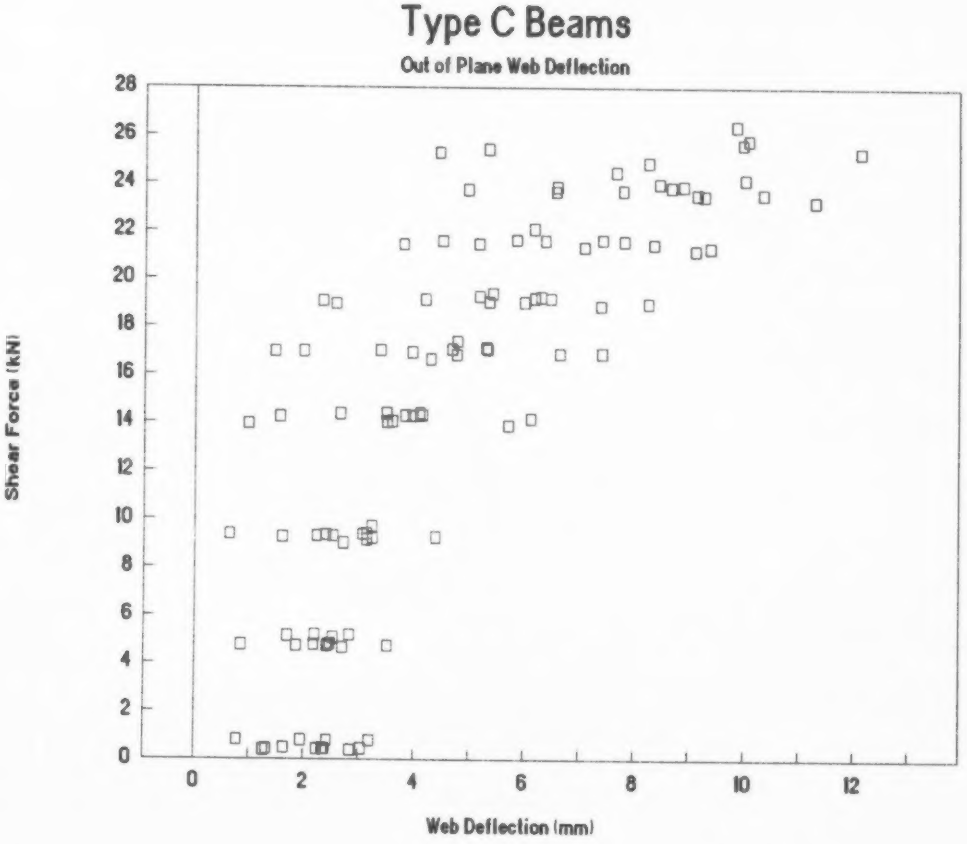


Figure 4.17 - Type C beams, out-of-plane web deflection vs. shear force

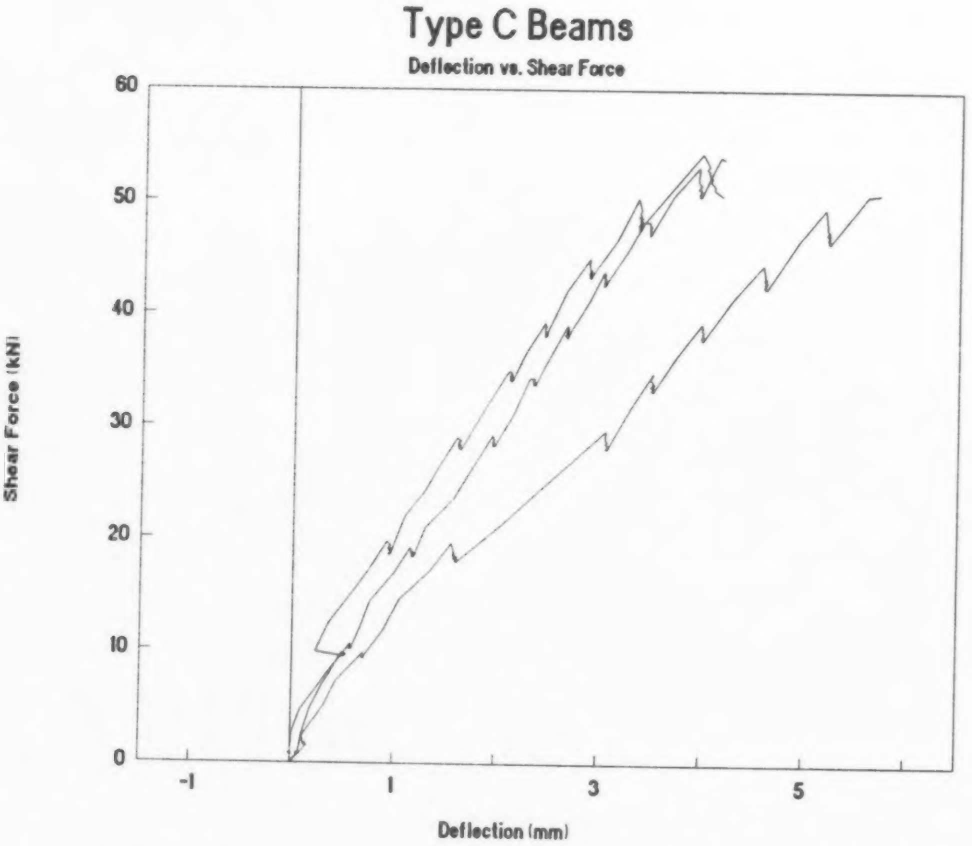


Figure 4.18 - Type C beams load point deflection vs. shear force between panels A/H and B/G

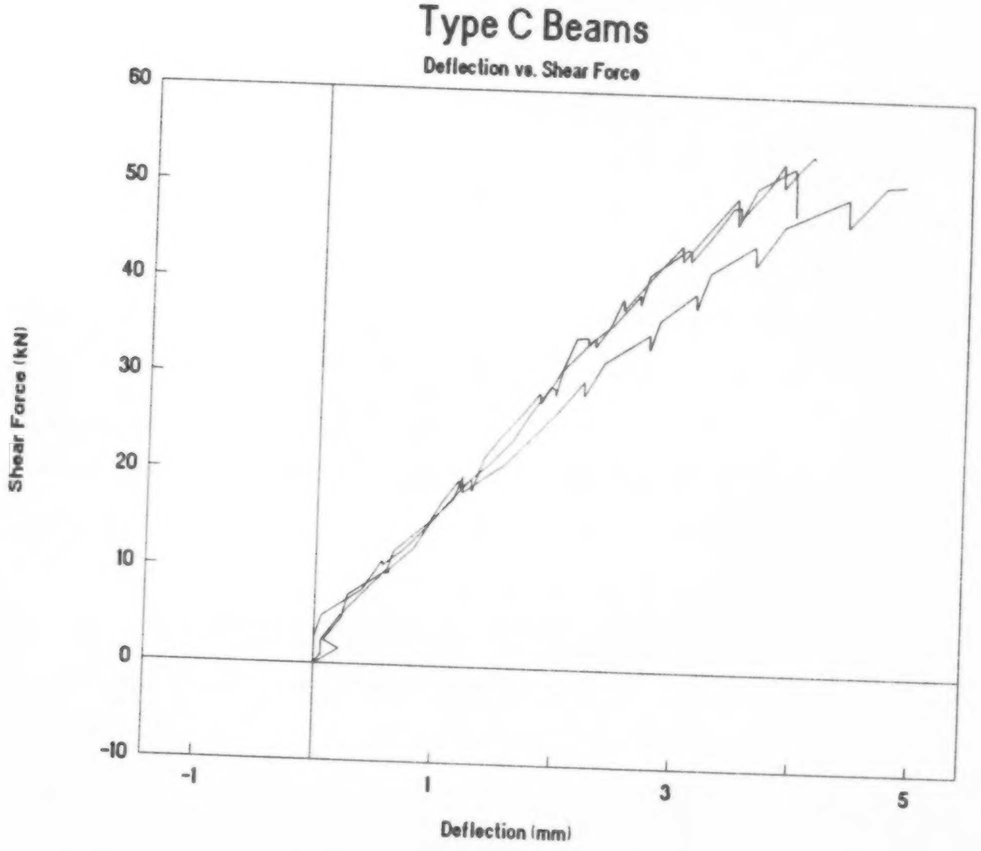


Figure 4.19 - Type C beams load point deflection vs. shear force between panels D/E and C/F

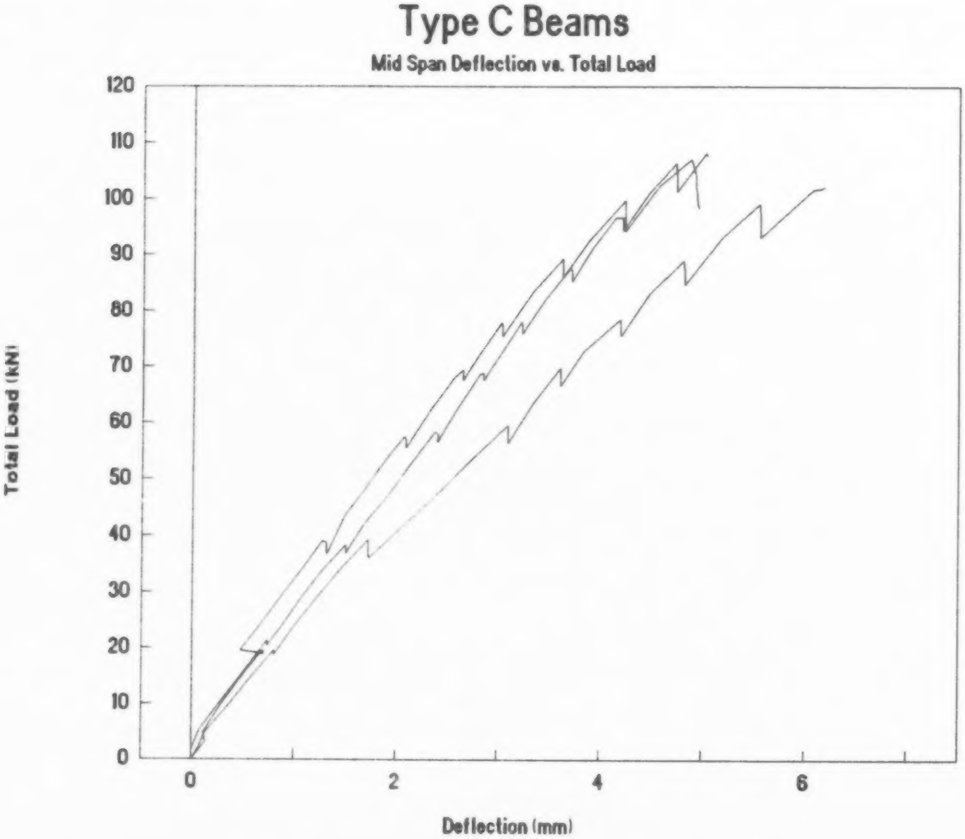


Figure 4.20 - Type C beams, mid span deflection vs. total load

5 Analysis and Discussion

5.1 Introduction

In this chapter, the test results presented in the preceding chapter are compared with the beam behaviour predicted by theory, published design methods and computer modelling. Previously developed methods of calculating tensile strength and elastic modulus at any angle to the grain are verified. The critical shear force is determined based on out-of-plane web deformation vs. panel shear force data and compared with the critical shear force predicted using methods described by Seydel (1933), Chapter 3. A plane frame computer model is used to estimate the diagonal tension stress which is compared with the tensile strength, in the direction of the tension diagonal, of the web panels based on the web panel tension tests. Deflection is broken down into its shear and flexural components. The measured shear deflection is compared with the plane frame model results and various methods of predicting shear deflection contained in published design guides for wood box beams as described in Chapter 3.

5.2 Material Properties

Most of the web material properties determined in the testing program were parallel and perpendicular to the face grain. The web panel material typical of the series B beams was also tested at 45° to the face grain. Because the tension diagonal angle was less than 45°, a method of relating the mechanical properties to any angle to the face grain was required. Equation 5.1 (Hankinson, 1921) provides a reasonably accurate method of determining the elastic modulus at an angle to the face grain, based on the limited available test data. The same equation can be used to calculate the tensile strength at an angle to the face grain (Bodig and Jayne, 1982), however, based on the tension test results, the exponents in the denominator should be 1.75 instead of 2.

$$E_{w\theta} = \frac{E_{w\parallel}\, E_{w\perp}}{E_{w\parallel}\, sin^{1.75}\,\theta + E_{w\perp}\, cos^{1.75}\,\theta} \qquad 5.1$$

An alternative method of determining the properties of panel products at an angle to the face grain is presented by the FPL (1987).

$$\frac{1}{E_{w\theta}} = \frac{1}{E_{w\parallel}} cos^4\theta + \frac{1}{E_{w\perp}} sin^4\theta + \frac{1}{G}\, sin^2\theta\, cos^2\theta \qquad 5.2$$

Both Hankinson's Formula (1921) (Equation 5.1 with exponents = 1.75) and the FPL, (1987) method (Equation 5.2) give results that are close to the measured elastic modulus at 45° to the face grain (Table 5.1).

Table 5.1 - Comparison of methods of calculating elastic modulus and tensile strength at 45° to face grain with test results

Method	Elastic Modulus (MPa)	Test ÷ Calculated	Tensile Strength (MPa)	Test ÷ Calculated
Test	5560		14.7	
Hankinson	5370	1.04	14.0	1.05
Wood Handbook	4920	1.13		

5.3 Critical Shear Force

The critical shear force on the beam was estimated using Seydel's method (1933) described in Section 2.4. Table 5.2 summarizes the relevant web material and beam section properties which are used to calculate the critical buckling shear force for the various beam types. The α and β numbers required to use the curves shown in Figure 2.3, the shear buckling coefficient, critical shear stress and force are shown in Table 5.3.

Table 5.2 - Summary of web material properties and beam section properties

Beam	a (mm)	b (mm)	t (mm)	E_{wa} (MPa)	E_{wb} (MPa)	I_w^T (10^9 mm^4)	Q_w^T (10^6 mm^3)
Pilot	552	432	10.22	5740	4480	2.33	4.65
A	515	432	6.92	3780	4040	3.22	6.27
B	718	432	6.78	5430	5170	2.32	4.54
C	515	432	6.04	3230	5530	3.69	7.14

Table 5.3 - Calculated values for use with Figure 2.3, predicted critical shear stress and critical shear force per web panel, critical shear force per panel from test results

Beam	α	β	K_s	v_{cr} (MPa)	V_{cr} (kN)		
					Theory	Test	Test ÷ Theory
Pilot	0.81	0.32	13.2	11.4	58.5	---	---
A	0.83	0.32	13.3	4.92	17.5	20.4	1.17
B	0.61	0.32	12.0	5.65	19.5	14.8	0.76
C	0.73	0.34	12.8	4.25	13.3	17.7	1.33

Some difficulty was encountered in determining the experimental critical shear force due to the lack of a distinct break between pre-buckling and post-buckling behaviour. The plot of out-of-plane web deflection vs. shear force had a curved transition around the critical shear force. In previous work the out-of-plane web deflection was plotted against shear force resulting in a curved transition from pre-buckling to post-buckling (Voss et al. 1950). The point of tangency between the curve and post-buckling deflection was defined as the critical shear force, as shown in Figure 5.1. This method was not very precise requiring considerable judgement on the part of the person plotting the data and therefore difficult to replicate.

In this study, the experimental critical shear force was determined by separating the out-of-plane web deflection vs. panel shear force data points into two groups. One group of points consisted of all points below the load at which deflection, 15 kN, began to increase and the other group consisted of all points with deflection greater than 5 mm. A straight regression line was fitted to both groups of points and the intersection of the regression lines was designated the critical shear force (Table 5.3 and Figures 5.1, 5.2, 5.3 and 5.4). The critical shear force determined here is slightly lower than would have been determined using the Voss et al. (1950) method but has the advantage of less dependence on the judgement of the person plotting the data.

The test results shown in Table 5.3 range from 24% lower to 33% higher than the predicted critical shear force. The test results for beam types A and C are, as might be expected due to panel edge fixity, slightly higher than the predicted critical shear force. Beam type B however, had a lower than predicted critical shear force. There are several possible reasons for the low critical shear force in the Type B beams such as variation in the thickness and elastic properties within panels and between panels, and the difficulties associated with determining the critical shear force from test data. The degree of variation of material properties is shown in the coefficients of variation for Type B beams in Table 4.1. The slope of the upper portion of the out-of plane deflection vs. shear force plot of the Type B beams is higher than that of the Type A and C beams magnifying the effect of using the intersection of the straight lines rather Voss et al. (1950).

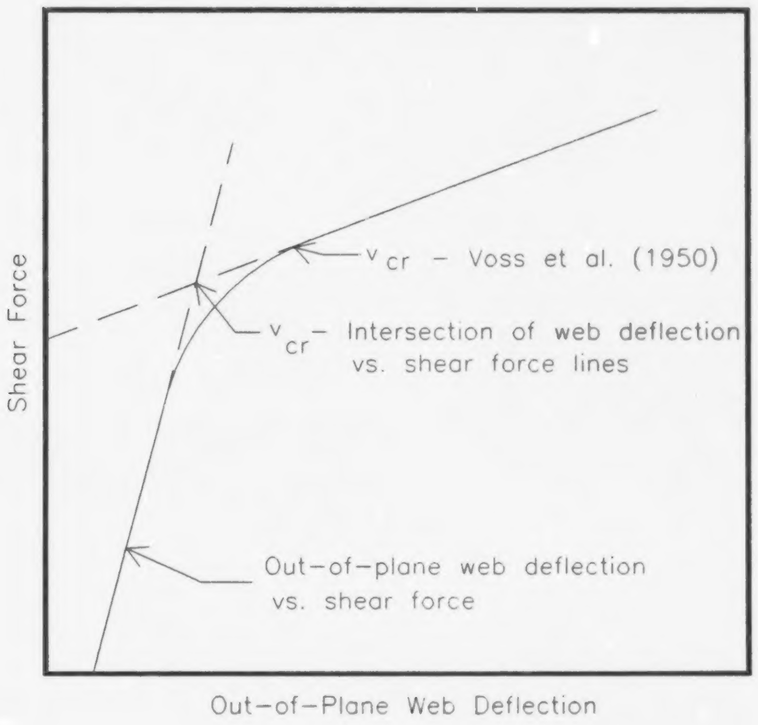

v_{cr} – Voss et al. (1950)
v_{cr} – Intersection of web deflection vs. shear force lines
Out-of-plane web deflection vs. shear force
Shear Force
Out-of-Plane Web Deflection

Figure 5.1 - Methods of determining critical shear force from test results

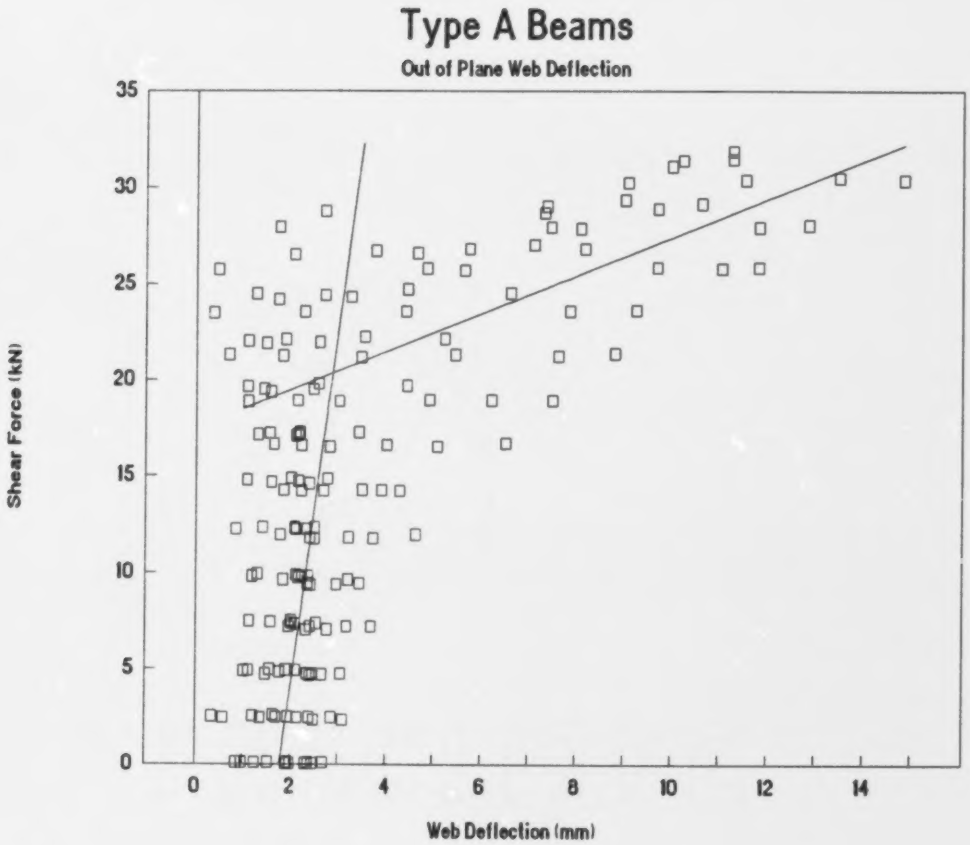


Figure 5.2 - Type A beams, determination of critical shear force

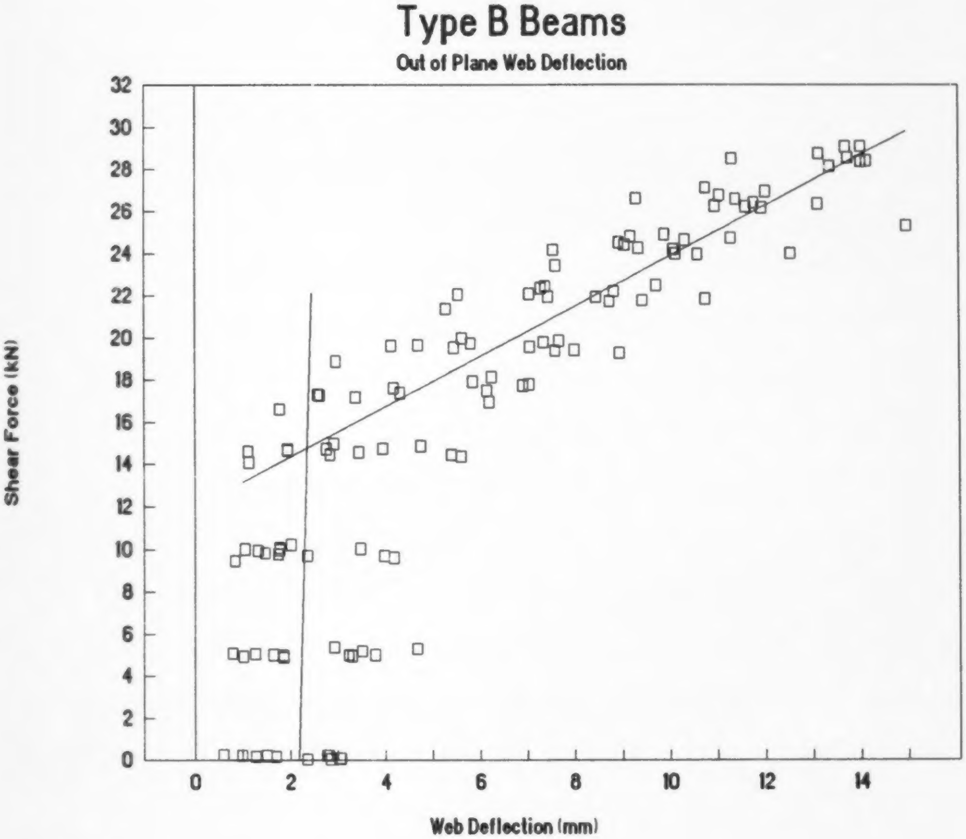


Figure 5.3 - Type B beams, determination of critical shear force

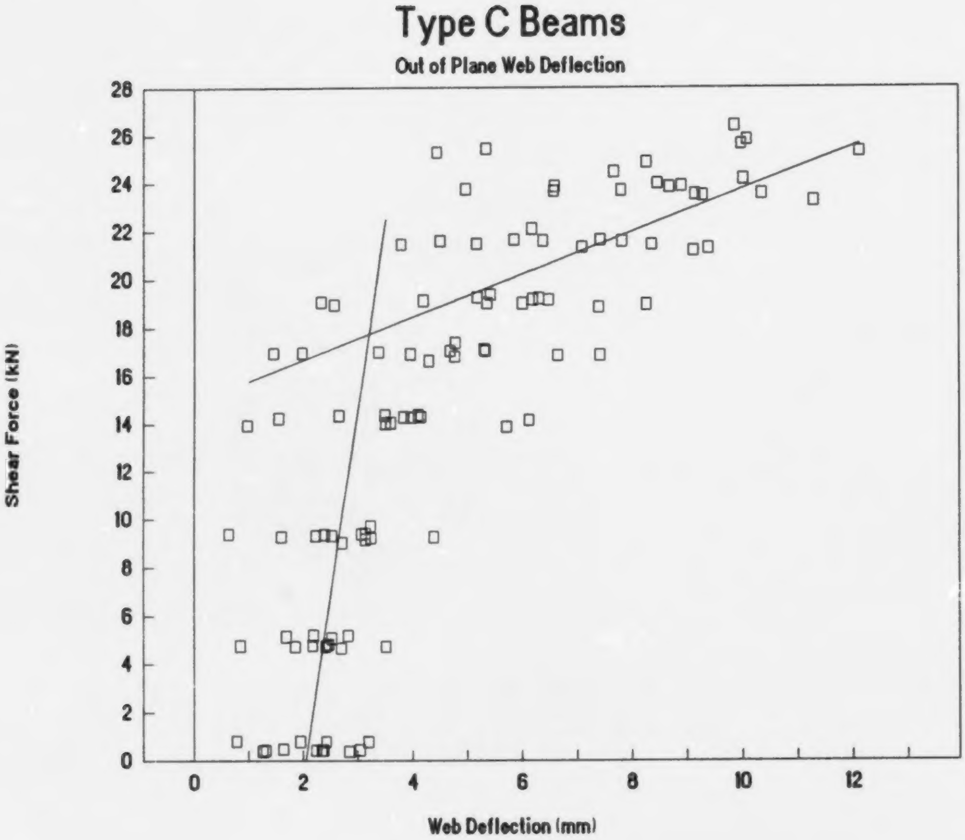


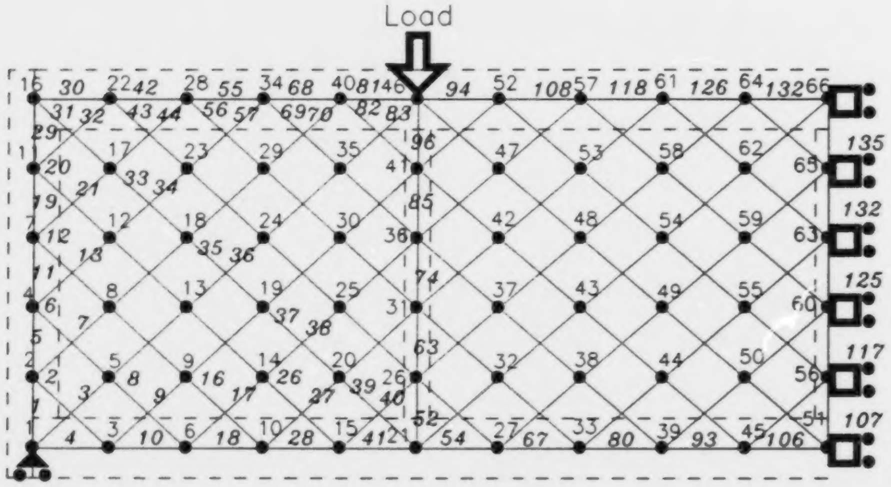
Figure 5.4 - Type C beams, determination of critical shear force

5.4 Plane Frame Model

Plane frame structural analysis programs analyze structures that can be represented as an assembly of beam elements. The nodes at each end of an element are free to move horizontally and vertically and to rotate as loads are applied to the structure. The axial and bending stiffness of each element can be specified so that axial and bending deformation of the elements will be close to that of the structure being analyzed. The program assembles the element stiffnesses into a system of simultaneous equations. Solving the system of equations provides the displacement of each node in the structure. The nodal displacements are used to determine the strain in each of the elements. The strain can then be used with the element's elastic and dimensional properties to determine the element stress (Murray, 1990).

The plane frame model used in this analysis followed the actual geometry of the beam. The assumption that plane sections remain plane when a beam is subjected to bending and the fact that the test beams were loaded symmetrically with respect to the beam span, lead to a further assumption that the transverse section through the beam at mid span would not deflect horizontally and would have no change in slope. The plane nature of the model allowed the use of transformed section properties for flanges and stiffener/load blocks. Combining these factors required that only one fourth of the beam be modelled and the results applied to the rest of the beam by symmetry.

The node and element numbering scheme for the plane frame model are shown in Figure 5.5. The dimensions and elastic properties of the model elements that represent the flanges and stiffeners are the actual properties of those components. The properties of the web elements are based on the actual thickness and tensile strength of the web panels as determined by measurement and testing. The width of the web elements is distance between element centre lines.



Node and element numbering for plane frame model.
Type A and C configuration shown above. Type B configuration is similar but with longer end panel.
Node numbers are in Roman type – eg. 21
Element numbers are in Italic type – eg. 26

Figure 5.5 - Plane frame model showing boundary conditions, node and element numbering

To account for the decrease in compressive stress after buckling, the elastic modulus in the direction of the compression diagonal was reduced in the model. Some compressive strength is required in the model to maintain the correct spacing between elements in tension and to compensate for the inability of the model to allow for increased tensile stresses due to out-of-plane deformation. Using the full compressive stiffness of the web elements resulted in a beam model that was too stiff.

To determine compressive elastic modulus for modelling purposes, the difference between the tensile strength parallel to the tension diagonal and the computed tensile stress using the plane frame model were plotted against various panel compressive elastic moduli. The reduced compressive elastic modulus was the value that resulted in a plane frame diagonal tensile stress which was equal to the diagonal tensile strength. The web compressive stiffness was found to be linearly related to panel tensile strength (Equation 5.3). With increasing tensile strength, the panel could deflect more before failing in diagonal tension. With increasing deflection, the web carries less compressive force which is reflected in the lower compressive stiffness. Using the reduced modulus of elasticity, shown in Table 5.5, in the web elements in the compression direction, the plane frame model resulted in deflections very close to the tensile deflections determined by testing (Table 5.6).

$$E_{wc} = 100\,(33.18 - \sqrt{2}\,f_{tw\theta}) \qquad 5.3$$

Table 5.4 - Panel diagonal tensile strength and diagonal compressive elastic modulus

Beam	$F_{tw\theta}$ (MPa)	E_c (MPa)
A	15.8	1090
B	15.7	1100
C	9.31	2000

Table 5.5 - Comparison of plane frame model and test results

Beam	Load Point Deflection			Mid Span Deflection		
	Test (mm)	Model (mm)	Test ÷ Model	Test (mm)	Model (mm)	Test ÷ Model
A	4.60	5.87	0.78	4.97	7.05	0.70
B	5.67	7.44	0.76	6.22	8.18	0.76
C	4.45	4.56	0.98	5.03	5.61	0.90

5.5 Shear Deflection

The measured beam vertical deflection is the arithmetic sum of the shear and flexural deflections. The flexural deflection due to normal stresses can be calculated by dividing the second integral of the bending moment by the beam stiffness. All beams are supported at both ends and therefore have the boundary condition of no deflection at the supports. The Equations 5.4 and 5.5 predict the flexural deflection at the point of load application and at mid-span and were derived through integration of the bending moment equation.

$$\Delta_{b\,LP} = \frac{P\,a}{6\,EI}\left(3La - 4a^2\right) \tag{5.4}$$

$$\Delta_{b\left(\frac{L}{2}\right)} = \frac{P\,a}{24\,EI}\left(3L^2 - 4a^2\right) \tag{5.5}$$

Shear deflection is the deflection due to shear stress and results in angular distortion of infinitesimal elements of the web. The following discussion of shear deflection is based on the assumptions:

1. All shear deformation occurs in the webs. This assumption is reasonable because the shear stress in the flanges in much lower the shear stress in the webs and the flange shear stress is low compared with the normal stress.
2. The shear stress is distributed uniformly throughout the web panels. The applied loads and the reactions are actually transmitted to the web

panel by the stiffeners and flanges combined. For design purposes, the plot of stress vs. depth is assumed to take the shape of a parabola with very little curvature.

3. The slope of the load-deflection curve is the same before and after web buckling has occurred. This is confirmed by plots of load point deflection vs. shear force.
4. The shear deflection is constant between applied loads. There are actually some small shear stresses in the interior web panels, as measured on the pilot test beam, but these will be considered to be negligible.

Shear deflection from test results and the plane frame model may be determined by subtracting the calculated flexural deflection, using equations 5.4 and 5.5, from the total measured deflection. Shear deflection can also be calculated using the various methods described in Chapter 2. Table 5.6 compares the test shear deflection and the various calculated values. The small magnitude of the deflection and the small number of samples do not justify placing very much value on these numbers. The actual panel thickness rather than the effective thickness for shear is used to calculate shear deflection using the APA method.

The top row of Table 5.6 shows the calculated bending deflection. Shear deflection calculated by subtracting the flexural deflection from the total deflection, probably the most accurate measurement of shear deflection is shown in the second row. The third row is the shear deflection determined using the FPL (1987) method, the highest estimate because only the area of the web between flanges is used and reasonably close to the test results. The CSA/COFI (1989) method provides an estimate of shear deflection that is much lower than any other method and than the test results. This method basically uses $I^T{}_w/(X_s\, h^2)$ instead of cross-sectional area divided a factor to allow for the non-uniform distribution of shear stresses. The use of $I^T{}_w/(X_s\, h^2)$ appears to result a number that is too large and consequently a low estimate of shear deflection. The shear deflection calculated according to the APA (1990) method is lower than that calculated using the FPL (1987) but is reasonably close to the test results. The last row shows the shear deflection calculated using the plane frame model which is the most conservative estimate.

For the purpose of estimating shear deflection, the shear modulus is calculated based on the orthotropic elastic moduli and a maximum Poisson's ratio of 0.30 (Bodig and Jayne, 1982). The lesser orthotropic Poisson's ratio is determined using Equation 5.7 (Seydel, 1933).

$$G = \frac{E_{wa}}{4\,(1 + \nu_a)} + \frac{E_{wb}}{4\,(1 + \nu_b)} \qquad 5.6$$

$$\nu_b = \nu_a\,\frac{E_a}{E_b} \qquad 5.7$$

Table 5.6 - Comparison of shear deflection calculations with test results

Shear Deflection at 100 kN Total Applied Load						
	Beam A		Beam B		Beam C	
	(mm)	Test ÷ Calc	(mm)	Test ÷ Calc	(mm)	Test ÷ Calc
$\Delta_{b\ LP}$	0.97		1.46		0.99	
Test-Δ_b	2.67		3.51		2.92	
FPL	2.91	0.92	2.28	1.54	3.28	0.89
CSA/COFI	0.91	2.93	1.30	2.70	0.73	4.00
APA	2.20	1.21	1.77	1.98	2.49	1.17
Model	4.90	0.54	6.03	0.58	3.57	0.82

6 Conclusions and Recommendations

6.1 Conclusions

The conclusions listed below can be drawn from this study.

1 The post-buckling failure mode for OSB beam webs is diagonal tension fracture with or without fracture due to curvature of the buckled web panel.

2 The ultimate shear capacity of OSB beam webs is greater than the web's critical shear load and can be predicted using a plane frame model with the diagonal compressive web member elastic modulus reduced as shown in equation 5.3.

3 Based on limited test data, the elastic modulus of OSB at any angle to the face grain can be determined using Hankinson (1921) or the method published in the Wood Handbook (FPL, 1987). The tensile strength of OSB at any angle to the face grain can be determined using Hankinson (1921) with 1.75 as the exponent in the denominator. More testing is required to confirm that these methods are applicable to OSB.

4 The critical shear load for an OSB beam web can be approximated using the method described by Seydel (1933).

5 The FPL (1987) method results in a calculated shear deflection that is reasonably close to the shear deflection determined by testing.

6 The CSA/COFI(1989) method underestimates shear deflection and requires further investigation.

6.2 Recommendations

The following recommendations for further research and changes to design codes are based on the test results:

1. Box beam design calculations should include provisions for web buckling and tension field action. Further work is required to develop a method of calculating the maximum diagonal tensile stress in box beam webs without using a plane frame model.

2. Wood box beam design methods should include a cautionary note to remind designers to check the bearing stresses at applied concentrated loads and at beam supports.

3. The method of predicting shear deflection described by the FPL (1987) should be used in design calculations.

References

American Plywood Association; August, 1986; Plywood Design Specification; Tacoma, WA

American Plywood Association; March, 1990; Plywood Design Specification, Supplement Two, Design and Fabrication of Plywood Lumber Beams; Tacoma, WA

American Society for Testing and Materials; 1985; D 198-84, Methods of Static Tests of Timbers in Structural Sizes; American Society for Testing and Materials; Philadelphia, PA; 1985

Bergmann and Reissner; 1932; Über die Knickung von recteckigen Platten bei Schubbeanspruchung; Z.F.M. Vol. 23, No.1, pp. 6-12; cited by Seydel (1933)

Bodig, J. and Jayne, B. A.; 1982; Mechanics of Wood and Wood Composites; Van Nostrand Reinhold Company; New York, NY

Canadian Standards Association; December, 1989; Engineering Design in Wood (Limit States Design), A National Standard of Canada, CAN/CSA-O86.1-M89; Canadian Standards Association, Rexdale (Toronto), ON

Council of Forest Industries of British Columbia; revised November, 1989; Design of Glued and Nailed Plywood Web Beams, Vancouver, BC

Forest Products Laboratory, Forest Service, United States Department of Agriculture; Wood Handbook: revised, 1987; Wood as an Engineering Material; U. S. Government Printing Office; Washington, DC

Hankinson, R. L.; 1921; Investigation of crushing strength of spruce at varying angles of grain; U. S. Air Service Information Circular 3(259), Material Section Paper 130

Hilson, B. O. and Rodd, P. D.; June, 1979; The ultimate Shearing strength of timber I-beams with hardboard webs; Structural Engineer; vol 57B, No. 2

Kuhn, P., Peterson, J. P., Levin, L. R.; May, 1952; A Summary of Diagonal Tension, Technical Note 2661; National Advisory Committee on Aeronautics, Langley Aeronautical Laboratory; Langley Field, VA

Lewis, W. C. and Dawley, E. R.; October, 1943; Design of Plywood Webs in Box Beams - Stiffeners in Box Beams and Details of Design; Report 1318-A; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Lewis, W. C., Heebink, T. B., Cottingham, W. S. and Dawley, E. R.; October, 1943a; Design of Plywood Webs in Box Beams - Buckling in Shear Webs of Box and I Beams and the Effect upon Design Criteria; Report 1318-B; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Lewis, W. C., Heebink, T. B., Cottingham, W. S. and Dawley, E. R.; August, 1944a; Design of Plywood Webs in Box Beams - Additional Tests of Box Beams and I Beams to Substantiate Further the Design Curves for Plywood Webs in Box Beams - Tests of Plywood Webs in the Tension Field; Report 1318-C; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Lewis, W. C., Heebink, T. B. and Cottingham, W. S.; October, 1944b; Design of Plywood Webs in Box Beams - Buckling and Ultimate Strengths of Shear Webs of Box Beams having Plywood Face Grain Direction Parallel or Perpendicular to the Axis of the Beams; Report 1318-D; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Lewis, W. C., Heebink, T. B. and Cottingham, W. S.; December, 1944c; Design of Plywood Webs in Box Beams - The Effect of Repeated Buckling on the Ultimate Strengths of Box Beams with Shear Webs in the Inelastic Buckle Range; Report 1318-E; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

March, H. W.; April, 1942a; Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear; Report 1316; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

March, H. W.; September, 1942b; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling of Flat Isotropic Plates in Compression, Shear or Combined Compression and Shear; Report 1316-A; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

March, H. W.; November, 1942c; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling of Plates of any Symmetric Construction. Edges Simply Supported. Buckling of Plates with Two Edges Clamped; Report 1316-B; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

March, H. W.; January, 1943a; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Plates Having the Grain of the Face Plies Inclined to the Edges; Report 1316-C; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

March, H. W.; October 1943b; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling of Long, Flat Plywood Plates Under Uniform Shear. Grain of the Face Plies Inclined to the Edges. Edges Clamped; Report 1316-F; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

McNatt, J. D.; October, 1980; Hardboard-Webbed Beams: Research and Application; Forest Products Journal, vol. 30, No. 10, p. 57-64

Murray, D. W.; 1990; Advanced Structural Analysis I, Civ E 660, Lecture Notes; University of Alberta; Edmonton, AB

Norris, C. B. and Voss, A. W.; June, 1943a; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling of Plywood Plates in Compression with Face Grain at 0° and 90° to Load; Report 1316-D; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Norris, C. B. and Voss, A. W.; October, 1943b; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Effective Width of Thin Plywood Plates in Compression with the Face Grain at 0° and 90° to Load; Report 1316-E; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Norris, C. B. and Voss, A. W.; November, 1943c; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling Tests of Flat Plywood Plates in Compression with Face Grain at 15°, 30°, 45°, 60° and 75° to Load; Report 1316-G; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Norris, C. B., Voss, A. W. and McKinnon, P. F.; March, 1945; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Effective Width of Thin Plywood Plates at Maximum Load in Compression with the Face Grain at 0°, 15°, 30°, 45°, 60°, 75°, and 90° to Load; Report 1316-I; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Popov, E. P. with Nagarajan, S., and Lu, Z. A.; 1978; Mechanics of Materials, second edition, Prentice/Hall International, Inc.; London; by Prentice-Hall, Inc. Englewood Cliffs, NJ

Ringelstetter, L. A.; February, 1949; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling Tests of Flat Plywood Plates in Compression with Face Grain at 45° to Load -- Loaded Edges Clamped, Others Simply Supported; Report 1316-J; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Seydel, E.; April, 1933; The Critical Shear Load of Rectangular Plates, Technical Memorandums, No. 705; National Advisory Committee for Aeronautics; Washington, DC

Timoshenko, S. P.; 1921; Über die stabilität versteifter Platten; Zeitschrift "Der Eisenbau", Vol. 12, Nos. 5 and 6, pp 147-163; cited by Seydel (1933)

Timoshenko, S. P. and Gere, James M.; 1961; Theory of Elastic Stability; McGraw-Hill Book Company; Toronto, ON

Thorburn, L. J., Kulak, G. L., Montgomery, C. J.; 1983; Analysis of Steel Plate Shear Walls; Structural Engineering Report No. 107; Department of Civil Engineering, University of Alberta, Edmonton, AB

Trayer, G. W.; 1930; The Design of Plywood Webs for Airplane Wings; Technical Report NO. 334; National Advisory Committee for Aeronautics; Washington, DC

Trayer, G.W. and March, H. W.; 1930; Elastic Instability of members having sections common in aircraft construction; Report No. 382; National Advisory Committee for Aeronautics; Washington, DC

Voss, A. W., Norris, C. B. and Palma, Joseph Jr.; revised, July, 1950; Supplement to Buckling of Flat Plywood Plates in Compression, Shear or Combined Compression and Shear - Buckling of Flat Plywood Plates in Uniform Shear with Face Grain at 0°, 45°, and 90°; Report 1316-H; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

Withey, M. O.; March, 1943; Design of Plywood Webs in Box Beams; Report 1318; U. S. Department of Agriculture, Forest Service, Forest Products Laboratory; Madison, WI

APPENDIX A

Materials Test Data

Pilot Test Beam - Web Panel Tension Tests

Panel testing done at the Alberta Research Council, October 14, 1991

Pilot Test Beam - Panels manufactured by Weyerhaeuser Canada Ltd.
Edson, Alberta, June 7, 1991

Average Moisture Content - 5.5%

Sample	Orientation	Width (mm)	t (mm)	Area (mm^2)
P-1-B	Para	293	10.00	2930
P-1-F	Para	292	9.96	2908
P-1-C	Perp	293	10.77	3156
P-1-G	Perp	292	10.13	2958
Mean		292.5	10.22	2988
C. of V.		0.20%	3.69%	3.80%

Stress, Strain and Modulus of Elasticity

Sample	Orientation	Delta L (mm)	Delta Force (kN)	E (MPa)	Ult. Force (kN)	Ult. Stress (MPa)
P-1-B	Para	0.040	22.24	4866	49.42	16.87
P-1-F	Para	0.036	22.24	5463	47.95	16.49
Mean				5164		16.68
C. of V.				8.17%		1.61%
P-1-C	Perp	0.091	22.24	1974	36.70	11.63
P-1-G	Perp	0.027	22.24	7161	32.78	11.08
Mean				4568		11.36
C. of V.				80.30%		3.40%

Tension Test Results - Type A Beams

Panel testing done at the Alberta Research Council, October 14, 1991

Type A Beams - Panels manufactured by Weyerhaeuser Canada Ltd.
Edson, Alberta, May 19, 1991

Average Moisture Content - 5.1%

Test Sample Dimensions

Sample	Orientation	t (mm)	Width (mm)	Area (mm^2)
A-1-C*	Para	6.78	293	1987
A-1-G	Para	6.96	292	2032
A-2-B	Para	6.78	292	1978
A-2-G	Para	6.85	292	2000
A-3-C	Para	6.91	292	2018
A-3-F	Para	7.12	291	2070
A-1-B	Perp	6.64	292	1939
A-1-F	Perp	7.02	293	2055
A-2-C	Perp	6.68	292	1951
A-2-F	Perp	6.71	291	1953
A-3-B	Perp	6.80	291	1979
A-3-G	Perp	7.03	291	2044
Mean		6.85	291.33	1999.39
C. of V.		2.01%	0.23%	1.97%

Tension Test Results - Type A Beams

Stress, Strain and Modulus of Elasticity

Sample	Orientation	Delta L (mm)	Delta Force (kN)	E (MPa)	Ult. Force (kN)	Ult. Stress (MPa)
A-1-C*	Para	0.59	22.24	4785	35.23	17.74
A-1-G	Para	0.72	22.24	3840	36.97	18.19
A-2-B	Para	0.76	22.24	3773	35.99	18.19
A-2-G	Para	0.89	22.24	3177	32.07	16.03
A-3-C	Para	0.82	22.24	3423	30.56	15.15
A-3-F	Para	0.75	22.24	3654	32.92	15.90
Mean				3775		16.83
C. of V.				14.60%		7.89%
A-1-B	Perp	0.61	22.24	4780	32.92	16.98
A-1-F	Perp	0.90	22.24	3048	43.02	20.93
A-2-C	Perp	0.48	22.24	6002	31.09	15.92
A-2-F	Perp	0.99	22.24	2913	28.47	14.60
A-3-B	Perp	0.79	22.24	3626	45.46	22.97
A-3-G	Perp	0.71	22.24	3886	27.49	13.45
Mean				4042		17.49
C. of V.				28.88%		21.37%

Notes: Sample were extended to fit the testing equipment additional panels to the ends of the test samples.

Initial length of LVDT is 10" (254 mm)

* Indicates that the test sample failed at the glue joint.

Tension tests - Type B Beams

Panel testing done at the Alberta Research Council, October 14, 1991

Pilot Test Beam - Panels manufactured by Weyerhaeuser Canada Ltd.
Drayton Valley, Alberta, July 27, 1991
Panels Stamped CSA 437.0, Grade O-2

Average Moisture Content - 3.1%

Test Sample Dimensions

Sample	Orientation	t (mm)	Width (mm)	Area (mm^2)
B-1-B	Para	6.70	292	1956
B-1-E	Para	6.95	292	2030
B-2-B	Para	6.85	292	2000
B-2-E	Para	6.88	291	2001
B-3-B	Para	6.85	292	2000
B-3-E	Para	6.88	293	2014
B-1-B	Perp	6.70	292	1956
B-1-E*	Perp	6.92	292	2022
B-2-B	Perp	6.85	292	2000
B-2-E	Perp	6.82	292	1993
B-3-B	Perp	6.88	292	2007
B-3-E	Perp	6.80	292	1986
B-45-1	45°	6.68	292	1949
B-45-2	45°	6.75	292	1971
B-45-4	45°	6.32	292	1847
B-45-5	45°	6.40	292	1869
Mean		6.76	292	1975
C. of V.		2.61%	0.13%	2.61%

Tension tests - Type B Beams

Stress, Strain, Elastic Modulus and Poisson's Ratio

Sample	Orientation	e(1)	e(2)	E (MPa)	F_t (MPa)	Poisson	G (MPa)
B-1-B	Para	0.002400		4737	18.30		
B-1-E	Para	0.002700		4058	16.74		
B-2-B	Para	0.001820		6110	19.88		
B-2-E	Para	0.001130	-0.000135	5903	19.92	0.119	2637
B-3-B	Para	0.001970		5645	17.52		
B-3-E	Para	0.000860	-0.000180	7703	18.48	0.209	3185
Mean				5429	18.52	0.164	2911
C. of V.				17.20%	8.81%	38.64%	13.32%
B-1-B	Perp	0.002140		5313	14.03		
B-1-E*	Perp	0.002700		4074	11.11		
B-2-B	Perp	0.002340		4752	14.28		
B-2-E	Perp	0.001200	-0.000140	5580	13.44	0.117	2499
B-3-B	Perp	0.001245	-0.000360	5339	15.59	0.289	2071
B-3-E	Perp	0.001880		5958	15.64		
Mean				5169	14.59	0.135	2285
C. of V.				12.88%	6.71%	107.54%	13.24%
B-45-1	45°	0.001160	-0.000450	5902	14.70	0.388	2126
B-45-2	45°	0.001055	-0.000425	6418	17.02	0.403	2287
B-45-4	45°	0.001540	-0.000470	4692	13.75	0.305	1797
B-45-5	45°	0.001370	-0.000470	5212	13.26	0.343	1941
Mean				5556	14.68	0.360	2038
C. of V.				13.66%	11.36%	12.33%	10.50%

Notes: Sample were extended to fit the testing equipment additional panels to the ends of the test samples.

Initial length of LVDT is 10" (254 mm)

* Indicates that the test sample failed at the glue joint.

Tension tests - Type C Beams

Panel testing done at the Alberta Research Council, October 14, 1991

Pilot Test Beam - Panels manufactured by Weyerhaeuser Canada Ltd.
Drayton Valley, Alberta, August 7, 1991
Panels not stamped with grade

Average Moisture Content - 3.5%

Test Sample Dimensions

Sample	Orientation	t (mm)	Width (mm)	Area (mm^2)
C-1-C	Para	6.05	292	1767
C-1-G	Para	6.05	292	1767
C-2-C	Para	6.42	292	1876
C-2-G	Para	6.27	291	1826
C-3-C	Para	6.88	292	2007
C-3-G	Para	6.13	293	1795
C-1-B	Perp	5.97	291	1739
C-1-F*	Perp	5.97	292	1745
C-2-F	Perp	6.10	292	1781
C-3-B	Perp	5.97	292	1745
C-3-F	Perp	6.18	293	1811
Mean		6.18	292	1805
C. of V.		4.34%	0.22%	4.36%

Tension tests - Type C Beams

Stress, Strain, Elastic Modulus,and Poisson's Ratio

Sample	Orientation	e(1)	e(2)	E (MPa)	F(t) (MPa)	Poisson	G (MPa)
C-1-C	Para	0.003080		4088	12.94		
C-1-G	Para	0.001750		7194	15.13		
C-2-C	Para	0.002690		4407	19.68		
C-2-G	Para	0.001075	-0.000470	6798	18.68	0.437	2365
C-3-C	Para	0.002900		3820	15.38		
C-3-G	Para	0.001080	-0.000470	6885	18.64	0.435	2399
Mean				5532	16.74	0.436	2382
C. of V.				28.56%	13.77%	0.33%	1.00%
C-1-B	Perp	0.003530		3624	10.21		
C-1-F*	Perp	0.001795	-0.000350	4261		0.195	1783
C-2-F	Perp	0.001470	-0.000385	2837	7.77	0.262	1124
C-3-B	Perp	0.004400		2897	8.95		
C-3-F	Perp	0.004890		2511	8.10		
Mean				3226	8.76	0.228	1454
C. of V.				21.92%	12.42%	20.71%	32.05%

Notes: Sample were extended to fit the testing equipment additional panels to the ends of the test samples.

Initial length of LVDT is 10" (254 mm)

* Indicates that the test sample failed at the glue joint.

Summary of Flange Compression Tests

Flange Material, Parallel to Grain

Beam Type	E (MPa)
A & B	11 650
C	10 550
P & C	8 710
Mean	10 303
C. of V.	14.42%

Flange Material, Perpendicular to grain, Load applied Parallel to Wide Face of Strands

Sample	E (MPa)
1	254

Flange Material, Perpendicular to grain, Load applied Perpendicular to Wide Face of Strands

Sample	E (MPa)
2	69

Summary of Stiffener/ Load Block Compression Tests

Average Moisture Content 8.5%

Stiffener/Load Block Material, Parallel to Grain
Single 38 x 89 S-P-F
OSB attached to both edges of samples

Sample	E (MPa)
A-3-C/D-E/F	6 870
B-1-A/F-B/E	3 110
B-1-B/E-C/D	3 330
B-2-A/F-B/E	5 020
B-2-B/E-C/D	3 570
B-3-A/F-B/E	5 890
B-3-B/E-C/D	4 350
Mean	4 591
C. of V.	30.74%

Stiffener/Load Block Material, Parallel to Grain
Double 38 x 89 S-P-F
OSB attached to both edges of samples

Sample	E (MPa)
A-1-D/E	3 490
A-2-D/E	8 990
A-3-D/E	7 110
B-1-A/F	4 750
B-1-C/D	12 770
B-2-A/F	3 330
B-2-C/D	3 100
B-3-C/D	8 620
Mean	6 520
C. of V.	53.16%

APPENDIX B

Box Beam Test Data

Preliminary Beam Tests July 10 & 11, 1991

July 10 test - mid span loading
July 11 test - beam loaded at 1/4 span points

Deflection

Total Load (kN)	Deflection (mm)			
	July 10	July 11		
	B/C-F/G	C/D-E/F	B/C-F/G	A/B-G/H
5				
10	0.00	0.00	0.00	0.00
15	0.34	0.15	0.14	0.14
20	0.57	0.30	0.32	0.27
25	0.84	0.45	0.46	0.38
30	1.04	0.60	0.63	0.56
35	1.31	0.75	0.79	0.68
40	1.57	0.93	0.97	0.85
45	1.86	1.07	1.08	0.96
50	2.12	1.21	1.29	1.10
55	2.40	1.39	1.50	1.26
60	2.69	1.57	1.64	1.43
65	2.94	1.70	1.79	1.54
70	3.32	1.86	1.99	1.68
75	3.57	2.03	2.13	1.83
80	3.86	2.19	2.27	1.97
85	3.97	2.34	2.47	2.11
90	4.29	2.49	2.64	2.25
95	3.78	2.67	2.83	2.39
100	5.09	2.83	2.96	2.54
105	5.36	2.99	3.15	2.68
110	5.39	3.16	3.34	2.84
115		3.41	3.54	3.01
120		3.62	3.75	3.21
125		3.86	4.03	3.43

Preliminary Beam Tests July 10 & 11, 1991

July 10 test - mid span loading
July 11 test - beam loaded at 1/4 span points

Web Stresses

July 10 test - End Panel

Total Load (kN)	σ_{min} (MPa)	σ_{max} (MPa)	τ_{max} (MPa)	θ Degrees
10	-0.336	0.193	0.264	23.8
15	-.0340	0.318	0.329	44.7
20	-0.629	0.302	0.466	36.8
30	-0.591	0.807	0.699	-42.9
40	-0.939	0.913	0.926	-43.8
50	-0.888	1.64	1.26	-37.7
60	-1.12	1.84	1.48	-36.2
70	-1.32	1.97	1.65	-39.3
80	-1.31	2.44	1.87	-37.6
90	-1.67	2.49	2.08	-41.1
100	-1.73	3.01	2.37	-40.3
110	-1.47	3.31	2.39	-38.1

Beam A-1 - August 14, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	125819	0.100	0.146	0.132	0.137	0.152		0.000		0.25	0.50	0.32
A	125833	0.286	0.119	-0.078	0.100	0.145		0.000		0.26	0.53	0.30
B	125848	0.221	0.013	0.038	0.421	0.352		0.000		0.25	0.51	0.29
C	125904	0.141	0.197	0.151	0.371	0.340		0.000		0.26	0.53	0.30
D	125921	0.318	0.377	0.351	0.506	0.378		0.000		0.25	0.49	0.30
E	125935	0.150	0.293	0.313	1.114	0.477		0.000		0.25	0.51	0.30
F	125954	0.439	0.528	0.658	0.877	0.502		0.001		0.29	0.49	0.26
G	130008	0.692	0.910	1.042	1.030	0.418		0.001		0.28	0.52	0.26
H	130023	0.926	1.303	1.306	1.357	0.511		0.001		0.28	0.52	0.26
I	130037	1.012	1.538	1.547	1.440	0.490		0.001		0.29	0.52	0.25
J	130054	1.035	1.641	2.068	1.595	0.465		0.001		0.30	0.51	0.25
K	130106	1.096	1.614	1.663	1.640	0.514		0.001		0.31	0.49	0.24
L	130130	0.404	0.814	0.805	0.662	0.309		0.000		0.28	0.49	0.25
M	130147	0.274	0.636	0.729	0.649	0.279		0.000		0.30	0.50	0.25
N	130203	0.241	0.626	-0.809	0.672	0.366		0.000		0.29	0.49	0.25
O	130221	0.629	0.943	0.976	0.993	0.515		0.000		0.28	0.51	0.26
R	130242	0.214	0.306	0.292	0.174	0.037		0.000		0.25	0.51	0.30
S	130305	-0.084	0.222	0.517	0.881	0.788		0.000		0.24	0.49	0.30
T	130320	0.021	0.504	0.918	1.240	0.880		0.000		0.25	0.54	0.30
U	130335	0.396	1.072	1.534	1.666	1.070		0.000		0.25	0.52	0.30
X	130739	0.146	0.400	0.507	0.536	0.339		-0.003		0.27	0.55	0.27
	131739							0.152		2.63	5.22	2.60
	131831	0.000	0.000	0.000	0.000	0.000	0.000	0.366	0.000	5.19	10.26	5.08
A	132315	0.228	-0.136	-0.222	-0.414	-0.297	0.002	0.367	0.066	5.05	9.97	5.02
B	132329	0.264	-0.189	-0.348	-0.322	-0.111	0.001	0.366	0.066	5.07	9.99	5.01
C	132341	0.234	-0.298	-0.239	-0.011	0.143	0.003	0.365	0.060	5.06	9.96	4.99
D	132354	0.068	-0.149	-0.191	-0.129	0.083	0.017	0.364	-0.013	5.08	10.00	5.00
E	132407	0.220	0.075	0.022	0.009	0.167	0.006	0.364	0.044	5.06	9.94	4.97
F	132420	0.064	-0.084	-0.053	0.046	0.339	-0.006	0.363	0.038	5.06	9.95	4.96
G	132440	0.343	0.157	0.332	0.429	0.468	0.032	0.363	0.085	5.08	9.95	4.93
H	132458	0.530	0.573	0.726	0.661	0.490	0.026	0.362	0.054	5.08	9.95	4.92
I	132517	1.045	0.951	0.968	0.898	0.580	0.008	0.362	0.042	5.08	9.95	4.91
J	132534	0.893	1.238	1.274	1.047	0.711	0.016	0.362	0.033	5.10	9.90	4.92
K	132550	0.935	1.350	1.365	1.245	0.965	0.019	0.362	0.031	5.09	9.90	4.91
L	132604	0.902	1.242	1.261	1.117	0.942	0.022	0.361	0.027	5.12	9.95	4.93
M	132631	0.238	0.414	0.376	0.114	-0.030	0.019	0.361	0.039	5.07	9.92	4.92
N	132651	0.118	0.218	0.299	0.054	0.044	0.022	0.361	0.049	5.07	9.89	4.92
O	132713	0.035	0.177	-1.353	0.130	0.015	0.016	0.361	0.037	5.06	9.86	4.92
R	132736	0.505	0.552	0.586	0.510	0.394	-0.010	0.360	0.014	5.02	9.87	4.91
S	132803	0.586	0.728	1.062	1.171	1.697	0.010	0.360	-0.016	4.98	9.82	4.95
T	132825	-0.383	-0.371	-0.106	0.219	0.365	0.008	0.360	-0.047	5.00	9.89	4.96
U	132845	-0.204	0.036	0.428	0.707	0.604	0.017	0.360	0.060	5.00	9.87	4.96
X	132903	0.276	0.681	1.095	1.210	0.869	0.017	0.360	0.041	4.99	9.86	4.97
	133054						0.220	0.529	0.271	7.60	14.99	7.42

Beam A-1 - August 14, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	133143	0.000	0.000	0.000	0.000	0.000	0.397	0.732	0.415	10.03	19.83	9.80
A	133550	0.506	0.619	0.453	0.149	-0.045	0.381	0.755	0.335	9.81	19.42	9.65
B	133606	0.744	0.675	0.437	0.331	0.220	0.380	0.755	0.326	9.81	19.39	9.63
C	133622	0.791	0.636	0.627	0.744	0.575	0.381	0.755	0.325	9.78	19.30	9.60
D	133643	0.662	0.824	0.623	0.622	0.461	0.383	0.756	0.330	9.80	19.34	9.59
E	133702	0.809	1.009	0.799	0.634	0.404	0.383	0.756	0.335	9.79	19.33	9.60
F	133715	0.608	0.843	0.668	0.696	0.570	0.384	0.756	0.335	9.80	19.34	9.57
G	133735	0.935	1.211	1.078	1.029	0.672	0.378	0.756	0.353	9.84	19.33	9.54
H	133748	0.962	1.524	1.569	1.289	0.689	0.386	0.756	0.335	9.83	19.29	9.52
I	133808	1.583	1.965	1.904	1.636	0.843	0.383	0.756	0.326	9.83	19.25	9.51
J	133826	1.529	2.301	2.038	1.787	0.975	0.394	0.756	0.344	9.83	19.26	9.52
K	133844	1.605	2.456	2.152	1.906	1.160	0.393	0.756	0.318	9.84	19.30	9.52
L	133901	1.626	2.293	2.067	1.915	1.268	0.395	0.756	0.324	9.82	19.29	9.53
M	133948	0.814	1.299	1.105	0.709	0.223	0.388	0.756	0.351	9.81	19.26	9.53
N	134007	0.675	1.075	1.021	0.627	0.279	0.387	0.756	0.338	9.78	19.18	9.51
O	134023	0.577	1.034	-0.594	0.748	0.279	0.402	0.757	0.345	9.79	19.25	9.53
R	134045	1.086	1.464	1.327	1.076	0.600	0.390	0.757	0.315	9.74	19.18	9.51
S	134111	0.644	0.705	0.546	0.230	-0.010	0.362	0.757	0.468	9.72	19.23	9.57
T	134135	0.148	0.384	0.494	0.727	0.590	0.451	0.758	0.235	9.70	19.22	9.57
U	134153	0.313	0.820	1.057	1.262	0.811	0.426	0.758	0.325	9.71	19.21	9.57
X	134212	0.771	1.480	1.770	1.704	0.993	0.432	0.758	0.264	9.71	19.22	9.56
	134337						0.584	0.984	0.516	12.68	25.07	12.38
	134425	0.000	0.000	0.000	0.000	0.000	0.761	1.161	0.633	15.21	30.08	14.85
A	134915	0.605	0.746	0.907	0.354	0.060	0.773	1.163	0.657	14.90	29.47	14.62
B	134931	0.729	0.669	0.784	0.418	0.213	0.781	1.163	0.653	14.85	29.36	14.57
C	134952	0.748	0.672	0.999	0.880	0.532	0.780	1.163	0.674	14.88	29.41	14.58
D	135011	0.683	0.864	1.096	0.768	0.498	0.778	1.163	0.649	14.87	29.37	14.55
E	135028	0.792	1.131	1.406	0.916	0.652	0.784	1.163	0.665	14.86	29.34	14.51
F	135048	0.615	1.000	1.230	1.572	0.702	0.792	1.163	0.676	14.85	29.31	14.51
G	135109	0.848	1.084	1.589	1.180	0.717	0.790	1.163	0.663	14.90	29.29	14.43
H	135125	1.065	1.614	2.441	1.597	0.880	0.789	1.163	0.669	14.86	29.24	14.42
I	135203	1.662	2.127	2.970	1.932	0.999	0.783	1.163	0.672	14.88	29.30	14.45
J	135218	1.580	2.631	3.398	2.160	1.141	0.781	1.163	0.636	14.86	29.27	14.43
K	135231	1.641	2.672	3.688	2.165	1.251	0.790	1.164	0.642	14.88	29.31	14.46
L	135245	1.633	2.427	3.039	1.984	1.328	0.789	1.164	0.643	14.88	29.30	14.45
M	135312	0.803	1.385	1.615	0.865	0.267	0.787	1.164	0.663	14.85	29.22	14.45
N	135328	0.681	1.124	1.527	0.745	0.296	0.793	1.164	0.645	14.85	29.23	14.44
O	135343	0.557	1.031	-0.489	0.863	0.274	0.791	1.164	0.644	14.85	29.27	14.45
R	135405	1.112	1.523	1.958	1.221	0.704	0.783	1.164	0.610	14.75	29.15	14.41
S	135426	0.725	0.990	1.306	0.775	0.625	0.818	1.164	0.724	14.75	29.23	14.51
T	135450	0.089	0.393	0.791	0.931	0.768	0.751	1.164	0.734	14.72	29.18	14.46
U	135507	0.251	0.826	1.649	1.507	1.087	0.785	1.164	0.712	14.75	29.22	14.50
X	135524	0.761	1.572	2.530	1.920	1.164	0.818	1.164	0.651	14.73	29.19	14.46
	135635						0.986	1.325	0.804	17.73	35.10	17.29

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load Mid	Shear C/F - D/E
	135706	0.000	0.000	0.000	0.000	0.000	1.132	1.513	0.911	20.23	40.04	19.72
A	140046	0.472	0.667	0.769	0.277	-0.015	1.142	1.505	0.964	19.90	39.40	19.46
B	140059	0.850	0.807	0.954	0.528	0.272	1.151	1.505	0.963	19.85	39.29	19.39
C	140116	0.748	0.669	1.080	0.878	0.498	1.151	1.505	0.958	19.85	39.27	19.39
D	140133	0.710	0.909	1.126	0.791	0.478	1.147	1.505	0.954	19.83	39.21	19.36
E	140148	0.716	1.187	1.300	0.801	0.470	1.150	1.505	0.956	19.84	39.21	19.35
F	140211	0.553	0.918	1.028	0.691	0.518	1.149	1.505	0.964	19.85	39.23	19.35
G	140228	0.864	1.119	1.689	1.316	0.856	1.147	1.506	0.960	19.86	39.16	19.29
H	140242	1.092	1.682	2.507	1.730	0.887	1.149	1.506	0.953	19.89	39.22	19.32
I	140259	1.629	2.250	2.805	2.094	1.026	1.146	1.506	0.958	19.86	39.17	19.29
J	140316	1.641	2.845	3.017	2.336	1.110	1.154	1.506	0.972	19.82	39.12	19.26
K	140330	1.735	2.985	3.210	2.299	1.241	1.159	1.506	0.963	19.80	39.10	19.25
L	140346	1.627	2.525	3.074	1.897	1.186	1.152	1.506	0.967	19.83	39.16	19.28
M	140414	0.742	1.306	1.417	0.695	0.066	1.154	1.506	0.968	19.81	39.07	19.27
N	140430	0.609	1.053	1.339	0.599	0.080	1.153	1.506	0.964	19.77	39.11	19.27
O	140446	0.494	0.949	-0.559	0.753	0.139	1.156	1.506	0.975	19.74	39.01	19.25
R	140509	1.134	1.420	1.842	1.135	0.567	1.168	1.506	0.965	19.73	39.00	19.27
S	140537	0.596	0.764	0.654	0.203	-0.068	1.156	1.507	1.067	19.70	39.02	19.32
T	140555	0.001	0.115	0.338	0.710	0.591	1.160	1.508	1.059	19.66	38.95	19.31
U	140616	0.140	0.690	1.365	1.382	0.981	1.161	1.508	1.041	19.67	38.93	19.25
X	140632	0.793	1.562	2.369	1.817	1.047	1.163	1.508	1.040	19.64	38.90	19.25
	141115						1.326	1.724	1.210	22.66	44.87	22.11
A	141711	0.484	0.690	0.811	0.253	-0.061	1.492	1.914	1.355	24.68	48.84	24.11
B	141727	0.783	0.828	1.047	0.536	0.252	1.495	1.914	1.355	24.64	48.77	24.07
C	141745	0.790	0.737	1.250	0.983	0.555	1.499	1.914	1.357	24.67	48.80	24.07
D	141804	0.712	1.004	1.244	0.902	0.524	1.494	1.915	1.361	24.64	48.72	24.03
E	141821	0.736	1.252	1.404	0.884	0.514	1.495	1.915	1.366	24.65	48.72	24.04
F	141837	0.612	1.056	1.203	0.826	0.639	1.494	1.915	1.340	24.65	48.74	24.03
G	141857	0.810	1.073	1.748	1.349	0.852	1.485	1.916	1.365	24.65	48.63	23.95
H	141913	0.983	1.797	2.923	2.032	1.076	1.495	1.916	1.355	24.66	48.64	23.95
I	141930	1.399	2.535	3.765	2.520	1.234	1.499	1.916	1.363	24.67	48.66	23.96
J	141946	1.720	3.239	4.370	2.695	1.235	1.499	1.916	1.363	24.64	48.59	23.93
K	142004	1.843	3.308	4.633	2.438	1.192	1.501	1.916	1.355	24.60	48.56	23.91
L	142027	1.802	2.779	3.268	2.075	1.207	1.505	1.916	1.354	24.63	48.60	23.93
M	142053	0.700	1.298	1.356	0.678	0.043	1.508	1.916	1.360	24.58	48.53	23.92
N	142111	0.562	1.018	1.308	0.567	0.046	1.504	1.916	1.354	24.55	48.51	23.92
O	142130	0.394	0.840	-0.925	0.740	0.126	1.504	1.916	1.355	24.52	48.50	23.90
R	142150	1.105	1.437	1.772	1.083	0.543	1.544	1.916	1.298	24.47	48.43	23.90
S	142213	0.526	0.687	0.492	0.081	-0.164	1.537	1.917	1.348	24.47	48.45	23.96
T	142232	-0.188	-0.126	0.049	0.611	0.626	1.546	1.917	1.467	24.44	48.40	23.91
U	142247	0.006	0.448	1.081	1.287	0.891	1.466	1.917	1.450	24.45	48.37	23.92
X	142306	0.660	1.465	2.336	1.865	1.136	1.487	1.917	1.305	24.44	48.37	23.90
	142409						1.662	2.131	1.499	27.62	54.64	26.92

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	142431	0.000	0.000	0.000	0.000	0.000	1.851	2.305	1.658	30.24	59.83	29.45
A	143514	0.598	0.886	1.104	0.479	0.114	1.856	2.306	1.683	29.34	58.06	28.65
B	143532	0.832	0.955	1.342	0.735	0.383	1.859	2.307	1.674	29.33	58.00	28.61
C	143550	0.767	0.860	1.571	1.264	0.755	1.858	2.307	1.681	29.34	58.05	28.60
D	143608	0.759	1.022	1.519	1.121	0.715	1.870	2.307	1.683	29.31	57.97	28.57
E	143625	0.595	1.298	1.592	1.070	0.682	1.860	2.307	1.683	29.32	57.92	28.58
F	143641	0.620	1.105	1.376	0.961	0.780	1.864	2.307	1.687	29.32	57.96	28.55
G	143703	0.794	1.083	2.026	1.649	1.116	1.872	2.307	1.681	29.36	57.96	28.52
H	143721	0.961	1.861	2.995	2.566	1.412	1.861	2.307	1.690	29.33	57.90	28.49
I	143736	1.408	2.831	3.150	3.179	1.578	1.871	2.308	1.695	29.31	57.87	28.48
J	143756	1.910	3.792	3.452	3.341	1.494	1.843	2.308	1.704	29.31	57.92	28.49
K	143813	2.124	3.912	3.573	2.873	1.346	1.834	2.308	1.702	29.28	57.87	28.47
L	143829	1.989	3.020	3.687	2.117	1.274	1.834	2.308	1.703	29.28	57.83	28.46
M	143859	0.747	1.460	1.755	1.038	0.460	1.840	2.308	1.707	29.25	57.79	28.46
N	143921	0.647	1.179	1.843	1.081	0.614	1.865	2.308	1.697	29.25	57.83	28.48
O	143936	0.350	0.781	-0.846	0.838	0.199	1.872	2.308	1.697	29.23	57.78	28.47
R	143955	1.101	1.360	1.850	1.170	0.634	1.871	2.308	1.686	29.17	57.70	28.45
S	144016	0.551	0.639	0.503	0.114	-0.094	1.868	2.309	1.697	29.16	57.72	28.51
T	144033	-0.341	-0.449	-0.201	0.629	0.756	1.868	2.309	1.700	29.16	57.73	28.49
U	144049	-0.114	0.246	1.064	1.483	1.023	1.870	2.309	1.692	29.15	57.72	28.49
X	144107	0.625	1.392	2.391	1.989	1.226	1.866	2.309	1.693	29.17	57.71	28.45
	144209						2.083	2.565	1.956	32.69	64.68	31.83
	144233	0.000	0.000	0.000	0.000	0.000	2.241	2.756	2.118	35.19	69.61	34.25
A	144858	0.461	0.723	0.874	0.272	-0.026	2.222	2.750	2.012	34.44	68.13	33.57
B	144914	0.764	0.840	1.289	0.610	0.283	2.227	2.750	2.031	34.44	68.09	33.56
C	144933	0.694	0.763	1.553	1.185	0.630	2.214	2.750	2.031	34.43	68.05	33.53
D	144949	0.685	0.953	1.414	1.061	0.617	2.214	2.750	2.041	34.42	68.05	33.49
E	145009	0.749	1.303	1.481	0.922	0.585	2.216	2.750	2.048	34.40	68.00	33.47
F	145025	0.516	1.063	1.168	0.852	0.690	2.226	2.749	1.999	34.38	67.91	33.44
G	145047	0.629	0.888	1.866	1.653	1.107	2.229	2.749	2.008	34.42	67.95	33.42
H	145108	0.788	1.801	2.296	2.968	1.615	2.228	2.749	2.006	34.40	67.89	33.39
I	145127	1.572	3.133	2.690	3.777	1.649	2.218	2.749	2.003	34.38	67.86	33.38
J	145159	2.065	4.482	6.529	3.839	1.592	2.237	2.749	2.040	34.35	67.83	33.36
K	145216	2.430	4.495	6.198	2.976	1.214	2.223	2.749	2.032	34.32	67.82	33.35
L	145238	2.135	3.290	3.812	1.978	1.154	2.233	2.749	2.023	34.31	67.83	33.36
M	145306	0.633	1.202	1.334	0.607	0.008	2.234	2.749	2.016	34.26	67.70	33.31
N	145321	0.555	0.767	1.253	0.502	-0.003	2.234	2.749	2.015	34.24	67.69	33.30
O	145337	0.189	0.487	-1.169	0.678	0.060	2.234	2.749	2.029	34.20	67.64	33.29
R	145352	1.122	1.303	1.642	0.936	0.487	2.239	2.749	2.017	34.17	67.63	33.30
S	145414	0.526	0.438	0.173	-0.205	-0.251	2.247	2.749	2.110	34.16	67.60	33.33
T	145431	-0.559	-0.945	-0.829	0.354	0.750	2.234	2.749	2.044	34.16	67.59	33.33
U	145447	-0.391	-0.135	0.635	1.296	1.123	2.234	2.749	2.044	34.18	67.60	33.35
X	145504	0.417	1.167	2.113	1.871	1.191	2.236	2.749	2.030	34.17	67.61	33.31
	145602						2.442	2.951	2.293	37.63	74.42	36.59

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	145638	0.000	0.000	0.000	0.000	0.000	2.593	3.139	2.452	40.13	79.32	39.01
A	150535	0.368	0.582	0.491	-0.086	-0.422	2.588	3.142	2.330	39.04	77.20	38.00
B	150553	0.754	0.780	1.129	0.437	0.003	2.583	3.142	2.349	39.06	77.20	38.00
C	150610	0.676	0.564	1.425	1.034	0.356	2.589	3.143	2.316	39.03	77.12	37.93
D	150629	0.624	0.705	1.199	0.921	0.352	2.594	3.143	2.343	39.03	77.14	37.92
E	150644	0.639	1.089	1.103	0.713	0.306	2.600	3.143	2.352	39.02	77.11	37.89
F	150701	0.452	0.780	0.683	0.458	0.281	2.594	3.143	2.366	39.02	77.07	37.85
G	150721	0.455	0.434	1.527	1.600	1.023	2.583	3.143	2.371	39.07	77.07	37.87
H	150741	0.482	1.512	4.087	3.453	1.764	2.596	3.144	2.368	39.02	77.00	37.83
I	150803	1.470	3.383	6.501	4.394	1.810	2.586	3.144	2.331	39.01	76.98	37.83
J	150827	2.179	3.757	7.503	4.273	1.247	2.602	3.144	2.352	39.00	76.98	37.81
K	150850	2.851	5.202	6.750	2.961	0.852	2.593	3.144	2.363	38.97	76.91	37.79
L	150909	2.459	3.473	3.608	1.706	0.716	2.599	3.144	2.350	38.95	76.89	37.78
M	150944	0.503	0.978	0.832	0.259	-0.346	2.598	3.145	2.363	38.90	76.79	37.75
N	151003	0.419	0.516	0.794	0.192	-0.362	2.600	3.145	2.372	38.87	76.77	37.75
O	151030	-0.017	-0.016	-1.789	0.358	-0.261	2.599	3.145	2.353	38.82	76.66	37.70
R	151053	1.085	1.033	1.091	0.516	0.128	2.587	3.145	2.441	38.82	76.73	37.75
S	151115	0.460	0.090	-0.557	-0.716	-0.664	2.580	3.146	2.313	38.78	76.67	37.77
T	151134	-0.932	-1.885	-2.096	-0.207	0.426	2.627	3.146	2.409	38.74	76.60	37.73
U	151153	-0.828	-1.043	-0.258	0.870	0.845	2.589	3.146	2.343	38.75	76.62	37.73
X	151210	0.178	0.668	1.550	1.576	0.947	2.601	3.146	2.351	38.72	76.57	37.70
	151413						2.832	3.409	2.555	42.73	84.41	41.48
	151445	0.000	0.000	0.000	0.000	0.000	2.984	3.601	2.681	45.22	89.31	43.88
A	151956	0.207	0.346	0.349	-0.165	-0.320	2.991	3.616	2.703	44.27	87.45	43.03
B	152013	0.539	0.698	1.299	0.512	0.133	2.993	3.616	2.714	44.24	87.38	42.98
C	152029	0.525	0.554	1.887	1.399	0.711	2.989	3.616	2.705	44.23	87.33	42.96
D	152048	0.374	0.535	1.325	1.233	0.671	2.992	3.616	2.714	44.20	87.29	42.91
E	152104	0.046	0.707	0.941	0.850	0.590	2.994	3.616	2.714	44.18	87.23	42.87
F	152121	0.087	0.342	0.358	0.426	0.496	2.994	3.616	2.707	44.19	87.24	42.86
G	152143	0.016	-0.106	1.281	1.836	1.447	3.002	3.617	2.709	44.17	87.13	42.78
H	152204	-0.369	0.955	4.446	4.330	2.335	3.003	3.617	2.724	44.16	87.10	42.78
I	152223	1.019	3.282	7.588	5.428	2.226	3.006	3.617	2.722	44.15	87.07	42.76
J	152252	1.998	5.591	8.822	4.831	1.405	2.999	3.617	2.721	44.10	87.00	42.72
K	152312	2.981	5.918	7.435	3.027	0.794	3.002	3.617	2.714	44.11	86.99	42.73
L	152336	2.476	3.547	3.435	1.273	0.547	2.996	3.617	2.710	44.06	86.86	42.66
M	152409	-0.040	0.346	0.348	0.045	-0.337	3.006	3.617	2.718	43.97	86.81	42.64
N	152426	-0.439	-0.553	0.103	-0.051	-0.372	2.969	3.617	2.736	43.97	86.76	42.64
O	152444	-0.735	-1.112	-2.736	0.041	-0.268	2.966	3.618	2.732	43.94	86.77	42.64
R	152502	0.685	0.381	0.379	0.066	0.019	3.013	3.618	2.721	43.87	86.67	42.62
S	152521	0.114	-0.358	-1.282	-1.216	-0.792	2.999	3.618	2.847	43.84	86.62	42.63
T	152538	-1.685	-3.188	-3.519	-0.711	0.548	3.002	3.619	2.745	43.83	86.60	42.60
U	152554	-1.585	-2.217	-1.213	0.639	1.009	2.971	3.619	2.753	43.81	86.59	42.58
X	152614	-0.486	-0.060	1.053	1.480	1.104	2.974	3.620	2.743	43.78	86.51	42.55
	152712	-0.029	-0.260	-0.582	-0.702	-0.595	3.216	3.885	2.922	47.69	94.15	46.25

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	153612	0.000	0.000	0.000	0.000	0.000	3.436	4.113	3.103	48.91	96.57	47.45
A	153629	0.390	0.701	0.607	0.978	0.513	3.430	4.114	3.113	48.89	96.49	47.40
B	153651	0.038	0.440	2.715	2.369	1.299	3.430	4.114	3.069	48.89	96.49	47.40
C	153715	-0.291	0.111	1.979	2.453	1.647	3.446	4.115	3.100	48.85	96.41	47.36
D	153732	-0.770	-0.198	0.918	1.759	1.581	3.453	4.116	3.079	48.83	96.36	47.33
E	153752	-0.689	-0.753	-0.334	0.828	1.336	3.430	4.117	3.155	48.79	96.26	47.28
F	153825	-0.676	-1.301	0.536	2.464	2.448	3.476	4.118	2.927	48.80	96.16	47.20
G	153849	-1.177	-0.245	4.556	5.657	3.615	3.483	4.119	2.948	48.81	96.21	47.20
H	153929	13.352	6.994	8.581	15.031	5.745	3.468	4.120	3.054	48.67	96.09	47.15
I	154010	-0.289	2.722	8.625	6.894	3.202	3.457	4.122	3.089	48.70	95.99	47.10
J	154032	1.489	5.777	9.930	5.730	1.838	3.465	4.122	3.127	48.68	95.97	47.08
K	154053	2.997	6.192	8.348	3.131	0.863	3.428	4.122	3.066	48.64	95.90	47.05
L	154112	2.579	3.360	2.830	1.180	0.899	3.443	4.123	3.162	48.63	95.88	47.04
M	154139	-1.006	-0.948	-0.565	0.282	0.163	3.447	4.124	3.145	48.58	95.83	47.02
N	154156	-1.499	-2.476	-1.254	0.123	0.196	3.455	4.125	3.124	48.55	95.78	47.01
O	154213	-2.050	-3.395	-4.790	-0.058	0.247	3.453	4.125	3.127	48.51	95.69	46.98
R	154237	0.196	-0.553	-0.881	-0.199	0.364	3.473	4.126	3.188	48.47	95.65	46.96
S	154302	-0.464	-1.431	-2.509	-1.599	-0.630	3.489	4.127	3.195	48.43	95.65	47.02
T	154325	-2.726	-5.302	-5.798	-0.996	1.090	3.396	4.127	3.113	48.41	95.59	46.98
U	154346	-2.831	-4.197	-2.803	0.773	1.724	3.437	4.127	3.097	48.36	95.49	46.93
X	154412	-1.542	-1.546	-0.032	1.714	1.658	3.486	4.127	3.056	48.34	95.44	46.91
	154502						3.704	4.457	3.336	52.70	103.99	51.01
A	155132	0.372	0.657	0.499	-0.049	-0.121	3.915	4.674	3.502	53.74	106.08	52.09
B	155154	1.022	2.250	3.456	1.476	0.515	3.912	4.675	3.498	53.70	105.99	52.02
C	155212	0.395	1.916	5.753	3.620	1.573	3.920	4.677	3.502	53.66	105.91	51.98
D	155235	-0.496	0.847	4.443	4.223	2.257	3.922	4.677	3.525	53.66	105.89	51.96
E	155252	-1.177	-0.270	2.085	3.115	2.378	3.928	4.680	3.524	53.59	105.80	51.87
F	155303	-0.902	-1.006	-0.038	1.318	1.589	3.914	4.680	3.479	53.59	105.74	51.88
G	155324	-0.842	-1.522	0.856	3.039	3.104	3.925	4.681	3.519	53.58	105.63	51.79
H	155344	-1.744	-0.314	5.495	6.947	4.263	3.931	4.682	3.498	53.57	105.64	51.78
I	155407	-0.659	2.875	10.418	8.146	3.586	3.929	4.683	3.499	53.51	105.52	51.71
J	155426	1.546	6.789	11.810	6.321	1.787	3.923	4.684	3.492	53.47	105.44	51.69
K	155503	3.549	7.521	8.942	3.044	0.595	3.934	4.686	3.519	53.44	105.37	51.66
L	155523	3.260	3.913	2.799	0.865	0.654	3.923	4.687	3.484	53.42	105.32	51.63
M	155546	-1.853	-1.757	-0.736	0.462	0.303	3.941	4.688	3.529	53.33	105.17	51.58
N	155604	-2.715	-4.386	-2.522	0.153	0.418	3.938	4.689	3.503	53.27	105.14	51.54
O	155621	-3.098	-5.817	-7.491	-0.824	0.269	3.940	4.689	3.479	53.26	105.10	51.54
R	155646	0.348	-0.558	-1.634	-1.089	-0.143	3.937	4.691	3.514	53.19	105.02	51.50
S	155715	-0.177	-0.969	-2.319	-1.537	-0.331	3.939	4.692	3.537	53.14	104.96	51.55
T	155737	-3.219	-6.650	-7.475	-1.543	1.171	3.933	4.692	3.494	53.10	104.89	51.51
U	155755	-3.607	-5.454	-3.698	0.820	2.051	3.947	4.693	3.531	53.09	104.86	51.48
X	155815	-2.059	-2.023	-0.055	2.071	1.911	3.952	4.694	3.488	53.08	104.83	51.47
	155925						4.248	5.058	3.729	57.75	113.98	55.86

Beam A-1 - August 14, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN) Shear	Forces (kN) Load	Forces (kN) Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	160049	0.000	0.000	0.000	0.000	0.000	4.518	5.367	4.026	60.24	118.95	58.27
A	160702	2.424	3.614	3.056	0.541	-0.199	4.613	5.420	3.881	58.40	115.41	56.60
B	160721	3.009	5.828	7.012	2.253	0.254	4.615	5.422	3.885	58.33	115.26	56.51
C	160739	1.952	5.343	10.625	5.429	1.866	4.617	5.423	3.886	58.31	115.21	56.48
D	160759	0.279	3.110	8.641	6.470	2.749	4.619	5.425	3.886	58.27	115.13	56.42
E	160815	-0.671	1.125	4.905	5.043	3.120	4.621	5.427	3.884	58.22	115.01	56.37
F	160832	-0.014	0.283	1.781	2.325	1.970	4.624	5.429	3.892	58.18	114.93	56.30
G	160851	0.274	-0.129	2.590	4.429	3.942	4.625	5.430	3.887	58.16	114.82	56.22
H	160913	-1.014	0.997	7.871	9.027	5.120	4.629	5.431	3.897	58.15	114.74	56.20
I	160933	-0.080	4.765	13.811	10.064	3.589	4.635	5.434	3.911	58.08	114.66	56.15
J	161002	2.690	9.693	15.699	7.314	1.246	4.639	5.436	3.918	58.02	114.52	56.08
K	161018	5.614	10.407	11.638	3.212	-0.032	4.639	5.436	3.919	58.00	114.49	56.07
L	161036	5.649	6.478	4.460	0.836	0.365	4.640	5.438	3.920	57.96	114.44	56.05
M	161058	-2.387	-1.343	0.768	1.348	0.487	4.642	5.439	3.917	57.89	114.33	55.99
N	161117	-3.850	-5.737	-2.795	0.609	0.689	4.643	5.439	3.921	57.82	114.16	55.94
O	161224	1.748	1.093	-0.998	-2.170	-1.270	4.639	5.444	4.075	57.71	114.01	55.85
R	161254	0.934	0.492	-1.424	-2.214	-1.539	4.648	5.445	3.923	57.59	113.88	55.85
S	161321	-1.848	-5.774	-6.830	-1.183	1.453	4.648	5.446	3.897	57.58	113.83	55.82
T	161342	-3.550	-5.416	-2.865	1.403	2.262	4.655	5.447	3.914	57.53	113.74	55.76
U	161400	-2.171	-1.453	1.365	2.713	1.971	4.659	5.447	3.949	57.51	113.70	55.76
	161906						5.190	6.071	4.378	63.96	126.36	61.85
	161959						5.378	6.269	4.550	65.06	128.55	62.91
	162037						5.407	6.300	4.625	64.32	127.02	62.16
	165238						10.037	8.381	4.718	27.72	55.74	27.51

Beam A-2 - August 15, 1991

										Forces (kN)		
Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	121516	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.22	0.52	0.21
A	121751	0.880	1.061	1.141	0.386	0.328	-0.007	-0.001	-0.037	0.25	0.55	0.30
B	121807	0.985	1.163	1.228	0.743	0.303	-0.002	-0.001	-0.038	0.25	0.55	0.28
C	121825	1.096	1.148	1.475	0.972	0.479	0.012	-0.001	0.007	0.25	0.55	0.29
D	121845	0.958	1.272	1.527	0.919	0.535	0.015	-0.002	-0.021	0.25	0.55	0.29
E	121905	0.956	1.205	1.320	0.865	0.524	0.015	-0.002	-0.008	0.25	0.53	0.28
F	121923	0.950	1.109	1.085	0.704	0.541	0.026	-0.001	-0.008	0.26	0.55	0.30
G	121945	0.666	0.877	0.991	0.712	0.550	0.031	-0.002	-0.028	0.30	0.56	0.25
H	122005	0.892	0.939	1.110	0.711	0.276	0.031	-0.002	-0.033	0.29	0.56	0.24
I	122027	0.912	1.288	1.754	1.043	0.625	0.027	-0.002	-0.024	0.30	0.56	0.24
J	122050	1.199	1.694	2.291	1.422	0.686	0.030	-0.002	-0.029	0.30	0.57	0.24
K	122113	1.377	1.937	2.693	1.734	0.744	0.035	-0.002	-0.015	0.29	0.56	0.25
L	122131	1.709	1.852	2.578	1.817	0.939	0.031	-0.002	-0.028	0.28	0.56	0.24
M	122201	1.345	1.877	2.367	1.666	1.285	-0.104	-0.002	-0.152	0.28	0.52	0.22
N	122220	1.131	1.647	2.291	1.681	0.794	-0.141	-0.001	-0.177	0.27	0.50	0.21
O	122238	0.869	1.363	1.838	1.395	0.652	-0.134	-0.001	-0.166	0.27	0.51	0.23
R	122301	0.458	0.461	0.468	0.219	0.353	-0.139	-0.001	-0.153	0.27	0.51	0.23
S	122324	0.321	0.362	0.400	0.353	0.138	-0.121	-0.002	-0.137	0.22	0.50	0.26
T	122351	0.569	0.720	1.081	0.537	0.562	-0.082	-0.002	-0.137	0.23	0.52	0.26
U	122412	0.399	0.636	0.961	0.594	0.315	-0.106	-0.002	-0.162	0.22	0.51	0.26
X	122435	0.746	1.044	1.254	0.855	0.531	-0.101	-0.002	-0.128	0.23	0.53	0.28
	122749	0.006	-0.077	0.030	-0.037	-0.088	0.251	0.268	0.196	2.78	5.45	2.68
A	123223	0.789	1.032	1.105	0.466	0.260	0.489	0.466	0.379	5.25	10.23	5.10
B	123244	0.994	1.268	1.303	0.658	0.291	0.489	0.467	0.400	5.23	10.17	5.05
C	123259	1.121	1.183	1.599	1.091	0.565	0.494	0.467	0.418	5.20	10.13	5.04
D	123316	0.996	1.139	1.632	0.886	0.478	0.491	0.467	0.409	5.19	10.11	5.02
E	123333	0.907	1.215	1.368	0.827	0.393	0.492	0.467	0.420	5.20	10.12	5.02
F	123354	1.084	1.107	1.182	0.736	0.613	0.493	0.467	0.424	5.23	10.16	5.04
G	123416	0.649	0.849	1.111	0.806	0.534	0.492	0.468	0.407	5.24	10.10	4.97
H	123436	0.836	0.992	1.264	0.713	0.218	0.495	0.468	0.413	5.25	10.11	4.98
I	123453	0.857	1.356	2.144	1.101	0.740	0.496	0.468	0.412	5.22	10.06	4.96
J	123511	1.190	1.733	2.483	1.513	0.747	0.497	0.468	0.411	5.23	10.10	4.96
K	123531	1.480	2.139	2.858	1.757	0.762	0.501	0.468	0.414	5.21	10.05	4.95
L	123553	1.765	1.977	2.842	1.885	0.945	0.500	0.468	0.413	5.19	10.03	4.93
M	123624	1.327	1.750	2.390	1.702	1.202	0.490	0.468	0.412	5.20	10.06	4.97
N	123647	1.099	1.790	2.377	1.503	0.614	0.492	0.468	0.417	5.19	10.03	4.96
O	123707	0.904	1.327	1.904	1.387	0.635	0.494	0.468	0.420	5.18	10.04	4.96
R	123727	0.438	0.498	0.560	0.378	0.118	0.495	0.468	0.416	5.16	10.02	4.96
S	123749	0.343	0.477	0.660	0.589	0.217	0.542	0.468	0.446	5.12	10.01	4.96
T	123810	0.505	0.611	1.026	0.594	0.464	0.555	0.468	0.484	5.15	10.06	4.99
U	123836	0.477	0.639	0.988	0.631	0.398	0.560	0.468	0.524	5.13	10.03	4.97
X	123858	0.708	1.043	1.200	0.902	0.569	0.559	0.468	0.525	5.12	9.99	4.95
	123953	-0.014	-0.007	0.054	0.035	-0.029	0.733	0.672	0.652	7.81	15.25	7.50

Beam A-2 - August 15, 1991

										Forces (kN)		
Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	124044	0.000	0.000	0.000	0.000	0.000	0.893	0.880	0.723	10.18	19.88	9.78
A	124515	0.893	1.176	1.082	0.249	0.260	0.919	0.883	0.801	9.99	19.54	9.66
B	124533	1.071	1.400	1.347	0.625	0.477	0.910	0.884	0.750	9.95	19.44	9.60
C	124551	1.157	1.306	1.512	0.964	0.649	0.904	0.884	0.735	9.95	19.44	9.59
D	124609	0.988	1.251	1.547	0.855	0.500	0.918	0.884	0.809	9.96	19.45	9.59
E	124627	0.897	1.263	1.393	0.834	0.592	0.922	0.884	0.810	9.95	19.41	9.58
F	124647	1.088	1.261	1.126	0.566	0.590	0.906	0.885	0.734	9.99	19.47	9.59
G	124710	0.672	0.875	1.031	0.644	0.481	0.907	0.886	0.742	10.02	19.48	9.57
H	124727	0.864	1.075	1.195	0.692	0.364	0.909	0.887	0.738	10.03	19.49	9.57
I	124746	0.984	1.484	2.005	1.109	0.840	0.927	0.887	0.815	9.98	19.38	9.53
J	124806	1.328	1.945	2.656	1.629	0.877	0.930	0.887	0.818	10.00	19.42	9.55
K	124826	1.529	2.274	3.047	1.836	0.918	0.929	0.887	0.816	10.01	19.43	9.54
L	124843	1.750	2.146	2.812	1.857	1.019	0.929	0.887	0.817	9.97	19.36	9.51
M	124911	1.368	1.861	2.344	1.479	1.208	0.932	0.887	0.821	9.97	19.35	9.52
N	124932	1.104	1.811	2.324	1.429	0.738	0.930	0.887	0.819	9.98	19.40	9.54
O	124953	0.899	1.414	1.993	1.425	0.864	0.932	0.887	0.822	9.97	19.36	9.52
R	125017	0.451	0.486	0.479	0.187	0.416	0.938	0.887	0.833	9.94	19.32	9.53
S	125045	0.373	0.471	0.459	0.190	0.284	0.919	0.887	0.752	9.91	19.36	9.59
T	125109	0.457	0.617	0.728	0.161	0.205	0.911	0.887	0.745	9.89	19.34	9.58
U	125126	0.452	0.737	0.783	0.518	0.409	0.914	0.888	0.746	9.91	19.38	9.60
X	125148	0.686	0.873	1.106	0.726	0.628	0.913	0.888	0.745	9.87	19.29	9.56
	125238						1.075	1.087	0.888	12.77	24.98	12.28
	125322	0.000	0.000	0.000	0.000	0.000	1.248	1.288	1.037	15.37	30.10	14.77
A	125730	0.934	1.160	1.102	0.346	0.193	1.250	1.292	1.082	15.07	29.50	14.54
B	125748	1.089	1.294	1.342	0.682	0.305	1.248	1.292	1.076	15.06	29.49	14.52
C	125805	1.186	1.298	1.592	1.105	0.635	1.248	1.292	1.078	15.04	29.44	14.50
D	125826	0.976	1.205	2.005	0.998	0.482	1.249	1.292	1.080	15.04	29.42	14.48
E	125846	0.924	1.195	1.387	0.858	0.476	1.251	1.292	1.077	15.04	29.41	14.48
F	125901	1.050	1.214	1.282	0.787	0.626	1.251	1.292	1.075	15.05	29.43	14.48
G	125922	0.655	0.849	1.043	0.758	0.370	1.258	1.293	1.055	15.11	29.49	14.44
H	125940	0.828	0.988	1.365	0.966	0.449	1.258	1.294	1.055	15.07	29.41	14.41
I	130001	0.896	1.465	2.152	1.367	0.910	1.259	1.294	1.059	15.11	29.47	14.45
J	130019	1.254	1.862	2.744	1.743	0.815	1.257	1.294	1.059	15.07	29.41	14.42
K	130037	1.368	2.138	3.176	2.081	0.927	1.262	1.295	1.058	15.09	29.44	14.43
L	130053	1.906	2.134	3.001	2.038	1.010	1.258	1.295	1.057	15.04	29.38	14.39
M	130119	1.358	1.853	2.400	1.680	1.120	1.260	1.295	1.055	15.03	29.34	14.39
N	130136	1.065	1.702	2.295	1.520	0.713	1.261	1.295	1.055	15.05	29.36	14.42
O	130156	0.801	1.313	1.955	1.539	0.820	1.261	1.295	1.056	15.04	29.38	14.41
R	130213	0.383	0.434	0.475	0.226	0.382	1.266	1.295	1.061	15.00	29.36	14.42
S	130233	0.373	0.450	0.565	0.291	0.186	1.260	1.295	1.085	14.95	29.30	14.44
T	130256	0.471	0.535	0.749	0.353	0.268	1.262	1.295	1.065	14.94	29.27	14.43
U	130312	0.474	0.711	0.969	0.732	0.494	1.265	1.295	1.064	14.97	29.33	14.43
X	130333	0.716	1.071	1.124	0.882	0.609	1.262	1.295	1.065	14.95	29.28	14.41
	130506						1.426	1.485	1.240	17.69	34.68	17.00

Beam A-2 - August 15, 1991

											Forces (kN)	
Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	131031						1.588	1.709	1.416	19.82	38.86	19.04
A	131046	0.928	1.121	1.184	0.345	0.315	1.590	1.709	1.417	19.78	38.79	19.10
B	131106	1.079	1.349	1.412	0.725	0.362	1.588	1.709	1.411	19.76	38.74	19.03
C	131125	1.175	1.227	1.610	1.011	0.563	1.615	1.709	1.522	19.78	38.78	19.04
D	131145	0.987	1.237	2.107	1.147	0.588	1.613	1.709	1.517	19.80	38.80	19.05
E	131203	0.863	1.204	1.536	0.969	0.544	1.606	1.709	1.467	19.78	38.75	19.06
F	131222	0.968	1.233	1.224	0.862	0.660	1.610	1.709	1.495	19.76	38.72	18.98
G	131241	0.527	0.669	0.831	0.542	0.189	1.589	1.708	1.377	19.80	38.65	18.92
H	131301	0.794	0.991	1.384	0.956	0.457	1.591	1.708	1.382	19.81	38.70	18.94
I	131322	0.878	1.384	2.238	1.392	0.757	1.589	1.708	1.391	19.80	38.67	18.92
J	131341	1.232	1.905	2.939	1.912	0.893	1.588	1.708	1.389	19.78	38.61	18.90
K	131359	1.452	2.293	3.450	2.262	1.022	1.590	1.708	1.396	19.74	38.57	18.88
L	131419	1.912	2.123	3.083	2.059	0.949	1.591	1.708	1.396	19.78	38.62	18.91
M	131445	1.331	1.852	2.351	1.641	1.044	1.590	1.708	1.402	19.77	38.64	18.90
N	131502	1.086	1.741	2.352	1.527	0.621	1.590	1.708	1.407	19.75	38.59	18.90
O	131530	0.786	1.298	1.990	1.528	0.746	1.590	1.708	1.403	19.73	38.57	18.90
R	131552	0.560	0.505	0.535	0.199	0.343	1.600	1.708	1.383	19.67	38.53	18.88
S	131617	0.336	0.505	0.540	0.402	0.243	1.599	1.708	1.457	19.63	38.50	18.94
T	131637	0.420	0.519	0.843	0.408	0.259	1.625	1.708	1.552	19.62	38.49	18.91
U	131656	0.463	0.662	0.886	0.635	0.465	1.622	1.708	1.548	19.63	38.53	18.92
X	131720	0.580	1.186	0.961	0.696	0.522	1.626	1.708	1.550	19.65	38.55	18.94
	131854						1.767	1.910	1.596	22.93	45.00	22.01
	131925	0.000	0.000	0.000	0.000	0.000	1.901	2.075	1.722	25.22	49.49	24.23
A	132616	0.999	1.290	1.201	0.325	0.298	1.892	2.080	1.762	24.64	48.35	23.71
B	132636	1.221	1.559	1.527	0.810	0.486	1.897	2.080	1.766	24.64	48.32	23.70
C	132653	1.232	1.524	1.961	1.234	0.662	1.896	2.080	1.759	24.63	48.30	23.67
D	132712	1.044	1.342	2.086	1.107	0.551	1.902	2.080	1.768	24.63	48.28	23.67
E	132733	0.860	1.317	1.507	0.914	0.539	1.898	2.080	1.766	24.63	48.28	23.69
F	132749	0.991	1.283	1.269	0.844	0.678	1.900	2.080	1.771	24.59	48.19	23.61
G	132813	0.552	0.754	0.941	0.746	0.363	1.906	2.080	1.755	24.67	48.22	23.58
H	132832	0.823	1.061	1.495	1.154	0.644	1.908	2.081	1.761	24.62	48.15	23.54
I	132851	0.902	1.571	2.511	1.730	1.031	1.904	2.081	1.763	24.65	48.18	23.56
J	132911	1.323	2.121	3.301	2.161	1.046	1.904	2.082	1.768	24.64	48.19	23.55
K	132935	1.545	2.501	3.737	2.386	1.102	1.906	2.082	1.765	24.61	48.13	23.53
L	132954	2.129	2.417	3.389	2.154	1.100	1.908	2.082	1.767	24.59	48.10	23.53
M	133023	1.339	1.875	2.410	1.580	1.020	1.905	2.082	1.775	24.57	48.07	23.52
N	133108	1.453	2.010	2.503	1.675	1.064	1.903	2.083	1.779	24.54	48.06	23.49
O	133126	1.109	1.873	2.465	1.572	0.693	1.902	2.083	1.782	24.54	48.04	23.50
R	133145	0.887	1.413	2.123	1.624	0.797	1.903	2.083	1.779	24.47	47.92	23.44
S	133205	0.325	0.452	0.452	0.222	0.455	1.910	2.083	1.723	24.53	48.05	23.53
T	133226	0.287	0.579	0.646	0.381	0.299	1.894	2.083	1.791	24.44	47.95	23.52
U	133244	0.527	0.658	0.843	0.350	0.333	1.905	2.083	1.780	24.43	47.95	23.52
X	133307	0.497	0.744	0.832	0.474	0.368	1.906	2.083	1.781	24.45	47.98	23.53
	133330	0.737	1.320	1.228	0.952	0.746	1.901	2.083	1.777	24.45	47.99	23.52
	133439						2.080	2.323	1.943	27.89	54.74	26.77

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											Forces (kN)	
Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	133509	0.000	0.000	0.000	0.000	0.000	2.230	2.489	2.071	30.37	59.64	29.16
A	134002	1.109	1.380	1.246	0.278	0.268	2.217	2.490	2.069	29.78	58.45	28.64
B	134020	1.190	1.609	1.521	0.629	0.338	2.222	2.491	2.100	29.74	58.36	28.59
C	134041	1.330	1.495	1.899	1.165	0.592	2.226	2.490	2.101	29.75	58.36	28.59
D	134059	1.088	1.469	2.004	1.188	0.591	2.228	2.491	2.100	29.71	58.29	28.54
E	134118	0.928	1.406	1.691	0.989	0.626	2.228	2.491	2.099	29.70	58.27	28.53
F	134137	1.007	1.323	1.475	0.943	0.725	2.227	2.491	2.100	29.72	58.30	28.55
G	134200	0.484	0.735	0.946	0.649	0.343	2.234	2.491	2.082	29.73	58.21	28.44
H	134219	0.735	1.033	1.670	1.240	0.621	2.234	2.492	2.085	29.73	58.22	28.45
I	134237	0.836	1.669	2.767	2.027	0.791	2.232	2.492	2.089	29.77	58.26	28.49
J	134301	1.369	2.402	3.958	2.717	0.916	2.231	2.492	2.095	29.69	58.14	28.41
K	134318	1.661	2.876	4.299	2.606	1.087	2.232	2.492	2.094	29.66	58.09	28.39
L	134339	2.108	2.594	3.620	2.248	1.098	2.235	2.492	2.095	29.69	58.15	28.41
M	134406	1.439	2.079	2.574	1.591	0.963	2.235	2.492	2.095	29.70	58.17	28.43
N	134423	1.115	1.943	2.687	1.573	0.629	2.235	2.492	2.093	29.69	58.16	28.43
O	134443	0.786	1.415	2.300	1.764	0.835	2.240	2.493	2.092	29.65	58.07	28.42
R	134504	0.407	0.519	0.500	0.147	0.389	2.251	2.492	2.040	29.59	58.03	28.39
S	134528	0.379	0.689	0.779	0.254	0.280	2.233	2.493	2.126	29.58	58.06	28.47
T	134548	0.510	0.720	0.746	0.253	0.252	2.240	2.493	2.130	29.59	58.10	28.46
U	134609	0.458	0.674	0.817	0.372	0.323	2.241	2.494	2.132	29.54	57.99	28.42
X	134629	0.742	0.876	1.077	0.591	0.578	2.239	2.494	2.135	29.53	57.97	28.41
	134722						2.418	2.727	2.290	32.86	64.52	31.55
	134821	0.000	0.000	0.000	0.000	0.000	2.590	2.922	2.424	35.29	69.34	33.88
A	135623	1.040	1.334	1.221	0.210	0.181	2.582	2.921	2.456	34.50	67.76	33.18
B	135643	1.240	1.722	1.613	0.756	0.402	2.582	2.921	2.453	34.52	67.81	33.18
C	135703	1.363	1.634	2.116	1.299	0.595	2.582	2.921	2.454	34.55	67.84	33.21
D	135724	1.098	1.537	2.186	1.299	0.654	2.582	2.921	2.457	34.50	67.75	33.14
E	135741	0.803	1.306	1.841	1.106	0.693	2.586	2.921	2.452	34.50	67.73	33.15
F	135806	0.995	1.297	1.500	0.937	0.814	2.586	2.921	2.453	34.47	67.68	33.10
G	135827	0.550	0.612	0.969	0.898	0.565	2.595	2.921	2.435	34.51	67.61	33.05
H	135847	0.570	0.832	1.848	1.671	0.725	2.594	2.921	2.439	34.50	67.62	33.03
I	135904	0.719	1.558	3.235	2.542	0.901	2.593	2.921	2.443	34.48	67.56	33.00
J	135924	1.259	2.553	4.528	3.122	1.075	2.592	2.921	2.446	34.46	67.53	32.99
K	135943	1.811	3.285	5.088	3.068	1.307	2.593	2.921	2.446	34.47	67.59	33.00
L	140007	2.426	2.935	4.074	2.411	1.109	2.591	2.921	2.448	34.42	67.52	32.98
M	140031	1.356	2.001	2.585	1.484	0.870	2.593	2.921	2.443	34.41	67.48	32.96
N	140047	1.078	1.975	2.819	1.529	0.580	2.593	2.921	2.443	34.39	67.44	32.95
O	140107	0.751	1.463	2.460	1.848	0.727	2.594	2.921	2.444	34.36	67.39	32.96
R	140126	0.325	0.338	0.507	0.176	0.547	2.597	2.921	2.398	34.36	67.44	32.97
S	140149	0.437	0.772	0.992	0.323	0.311	2.577	2.921	2.454	34.31	67.41	33.00
T	140210	0.606	0.761	0.875	0.213	0.339	2.588	2.921	2.460	34.27	67.33	32.97
U	140228	0.551	0.741	0.890	0.466	0.399	2.587	2.921	2.458	34.28	67.35	32.97
X	140247	0.633	1.307	1.101	0.733	0.511	2.588	2.921	2.458	34.26	67.33	32.93
	140338	0.021	0.064	0.033	-0.089	-0.045	2.785	3.147	2.642	37.95	74.56	36.43

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Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	140407	0.000	0.000	0.000	0.000	0.000	2.945	3.330	2.775	40.49	79.57	38.87
A	140816	1.112	1.461	1.266	0.336	0.225	2.929	3.330	2.751	39.66	77.92	38.14
B	140834	1.372	1.932	1.860	0.947	0.456	2.938	3.330	2.754	39.65	77.88	38.08
C	140850	1.533	1.948	2.521	1.505	0.568	2.939	3.330	2.778	39.65	77.88	38.11
D	140912	1.163	1.733	2.580	1.603	0.797	2.935	3.330	2.758	39.62	77.82	38.05
E	140928	0.766	1.488	1.980	1.366	0.825	2.937	3.330	2.790	39.59	77.73	38.01
F	140943	1.009	1.347	1.639	1.083	0.974	2.940	3.330	2.790	39.61	77.77	38.02
G	141007	0.462	0.520	0.949	1.083	0.706	2.949	3.330	2.782	39.57	77.60	37.90
H	141024	0.544	0.791	2.186	2.335	0.865	2.944	3.330	2.790	39.58	77.62	37.91
I	141043	0.616	1.692	4.144	3.566	0.923	2.943	3.331	2.789	39.58	77.63	37.90
J	141103	1.437	3.003	5.833	4.032	1.039	2.939	3.331	2.775	39.53	77.53	37.85
K	141120	2.173	3.999	6.229	3.763	1.232	2.951	3.331	2.762	39.51	77.49	37.84
L	141136	2.593	3.415	4.712	2.658	1.128	2.946	3.331	2.754	39.49	77.48	37.83
M	141203	1.367	2.066	2.704	1.625	0.880	2.949	3.331	2.759	39.47	77.43	37.83
N	141222	1.093	2.054	3.023	1.737	0.553	2.940	3.331	2.770	39.43	77.34	37.80
O	141239	0.722	1.499	2.643	2.192	0.774	2.941	3.331	2.792	39.42	77.34	37.79
R	141258	0.257	0.293	0.417	0.373	0.626	2.962	3.331	2.752	39.35	77.26	37.75
S	141317	0.393	0.846	0.969	0.391	0.308	2.942	3.331	2.748	39.32	77.24	37.80
T	141336	0.654	0.782	0.684	0.209	0.170	2.942	3.331	2.774	39.32	77.25	37.80
U	141356	0.502	0.648	0.567	0.237	0.323	2.949	3.331	2.785	39.32	77.24	37.81
X	141417	0.651	1.083	0.935	0.655	0.538	2.940	3.331	2.758	39.31	77.24	37.77
	141509						3.145	3.556	2.946	42.89	84.29	41.15
	141545	0.000	0.000	0.000	0.000	0.000	3.312	3.733	3.094	45.43	89.25	43.59
A	141937	1.115	1.536	1.312	0.311	0.173	3.313	3.733	3.081	44.63	87.66	42.90
B	141952	1.451	2.178	2.253	0.985	0.450	3.308	3.733	3.083	44.55	87.50	42.80
C	142013	1.592	2.241	3.126	1.917	0.670	3.319	3.733	3.086	44.54	87.48	42.78
D	142035	1.158	1.994	3.547	2.097	0.903	3.317	3.733	3.080	44.52	87.42	42.74
E	142139	0.689	1.475	2.367	1.788	1.048	3.315	3.733	3.082	44.42	87.21	42.66
F	142157	1.086	1.254	1.754	1.202	0.973	3.322	3.733	3.087	44.39	87.15	42.63
G	142221	0.397	0.330	1.053	1.414	1.152	3.328	3.733	3.109	44.42	87.12	42.56
H	142240	0.221	0.322	2.514	3.079	2.073	3.321	3.733	3.081	44.37	87.01	42.49
I	142258	0.258	1.667	5.254	4.660	2.791	3.320	3.733	3.090	44.34	86.98	42.49
J	142317	1.342	3.741	7.479	5.328	2.112	3.323	3.733	3.088	44.27	86.85	42.43
K	142337	2.333	4.901	7.629	4.352	1.493	3.327	3.733	3.091	44.29	86.89	42.44
L	142357	2.696	3.997	5.471	2.920	1.178	3.325	3.733	3.093	44.29	86.89	42.44
M	142427	1.372	2.224	2.891	1.668	0.712	3.322	3.733	3.098	44.24	86.76	42.39
N	142448	1.049	2.263	3.482	1.985	0.586	3.324	3.733	3.101	44.25	86.80	42.42
O	142507	0.604	1.459	2.998	2.547	0.776	3.325	3.733	3.088	44.17	86.64	42.36
R	142533	0.156	0.070	0.356	0.318	0.674	3.339	3.733	3.111	44.14	86.62	42.36
S	142557	0.346	0.816	1.093	0.404	0.259	3.324	3.733	3.123	44.11	86.60	42.40
T	142625	0.652	0.749	0.495	-0.055	0.050	3.324	3.733	3.115	44.05	86.52	42.35
U	142647	0.494	0.605	0.412	0.198	0.392	3.320	3.733	3.116	44.02	86.45	42.35
X	142714	0.543	1.035	0.574	0.479	0.526	3.331	3.733	3.136	44.01	86.45	42.31
	142911						3.710	4.165	3.419	50.59	99.33	48.54

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											Forces (kN)	
Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	A/H - B/G	Mid	C/F -D/E
	142930	0.000	0.000	0.000	0.000	0.000	3.713	4.165	3.409	50.34	98.84	48.29
A	143328	1.374	1.978	1.604	0.290	0.071	3.730	4.171	3.414	49.55	97.29	47.59
B	143346	1.813	3.096	2.957	1.158	0.272	3.739	4.171	3.414	49.52	97.19	47.57
C	143403	1.873	3.237	4.408	2.427	0.425	3.740	4.172	3.422	49.47	97.10	47.52
D	143421	1.190	2.626	4.455	2.785	1.185	3.738	4.173	3.420	49.45	97.05	47.46
E	143440	0.514	1.608	3.241	2.409	1.345	3.741	4.173	3.408	49.42	96.99	47.43
F	143458	0.769	1.198	1.835	1.497	1.144	3.741	4.173	3.422	49.39	96.93	47.38
G	143518	0.324	0.285	1.269	1.941	1.756	3.731	4.174	3.424	49.41	96.85	47.32
H	143537	-0.184	-0.005	2.922	3.881	2.554	3.746	4.176	3.407	49.39	96.81	47.29
I	143601	-0.080	1.772	6.499	5.860	3.399	3.748	4.176	3.427	49.34	96.74	47.26
J	143622	1.419	4.710	9.253	6.269	2.301	3.742	4.176	3.428	49.33	96.73	47.26
K	143644	2.705	6.165	9.229	4.783	1.422	3.745	4.176	3.422	49.31	96.69	47.23
L	143704	3.391	4.924	6.349	2.847	0.895	3.747	4.176	3.422	49.27	96.61	47.19
M	143730	1.483	2.550	3.277	1.580	0.579	3.753	4.177	3.446	49.27	96.61	47.21
N	143751	1.216	2.891	4.414	2.395	0.685	3.747	4.178	3.452	49.19	96.48	47.14
O	143812	0.627	1.881	3.988	3.195	1.441	3.746	4.178	3.426	49.15	96.38	47.11
R	143834	0.003	-0.029	0.309	0.489	0.774	3.764	4.179	3.415	49.15	96.41	47.13
S	143859	0.306	1.084	1.267	0.325	0.236	3.769	4.180	3.420	49.06	96.33	47.15
T	143923	0.877	0.767	-0.116	-0.633	-0.078	3.757	4.180	3.388	49.01	96.23	47.12
U	143947	0.511	0.336	-0.262	-0.249	0.273	3.756	4.180	3.392	49.01	96.24	47.08
X	144009	0.498	0.919	0.413	0.528	0.873	3.762	4.180	3.393	49.02	96.22	47.07
	144101						4.003	4.485	3.616	53.04	104.10	50.84
	144129	0.000	0.000	0.000	0.000	0.000	4.172	4.659	3.753	55.46	108.85	53.17
A	144638	1.812	2.550	2.000	0.292	0.037	4.231	4.689	3.777	54.21	106.42	52.06
B	144656	2.413	4.361	4.352	1.532	0.185	4.232	4.690	3.776	54.15	106.28	52.00
C	144719	2.408	4.598	6.821	3.617	1.534	4.227	4.690	3.778	54.06	106.11	51.91
D	144740	1.174	3.444	7.113	4.433	1.987	4.234	4.691	3.782	54.04	106.07	51.87
E	144759	0.207	1.682	4.594	3.725	1.986	4.231	4.692	3.777	53.98	105.94	51.81
F	144819	0.622	0.908	2.104	1.973	1.449	4.231	4.694	3.784	53.99	105.92	51.78
G	144844	0.171	-0.232	0.721	1.804	1.459	4.232	4.695	3.784	53.99	105.78	51.67
H	144911	-0.421	-0.477	3.304	4.931	3.204	4.234	4.696	3.782	53.92	105.72	51.67
I	144928	-0.495	1.770	7.699	7.094	3.984	4.238	4.696	3.781	53.90	105.65	51.64
J	145006	1.350	5.568	11.048	7.166	2.497	4.246	4.697	3.785	53.86	105.57	51.59
K	145027	3.275	7.304	10.619	5.061	1.241	4.241	4.698	3.781	53.81	105.53	51.57
L	145049	3.931	5.831	6.821	2.902	0.990	4.237	4.699	3.785	53.77	105.46	51.54
M	145125	1.762	3.153	3.917	1.752	0.423	4.248	4.702	3.774	53.71	105.33	51.48
N	145148	1.261	3.513	5.650	2.790	0.370	4.238	4.702	3.780	53.71	105.30	51.49
O	145213	0.441	2.219	5.421	4.152	1.676	4.245	4.702	3.774	53.62	105.19	51.43
R	145240	-0.041	-0.407	0.143	0.641	1.030	4.254	4.703	3.794	53.56	105.10	51.40
S	145304	0.518	1.359	1.057	-0.252	-0.217	4.474	4.703	3.788	53.49	105.03	51.42
T	145332	0.390	-1.427	-3.781	-2.495	-0.477	4.458	4.704	3.790	53.48	105.00	51.37
U	145358	-0.588	-2.000	-3.100	-1.178	0.283	4.463	4.705	3.784	53.42	104.89	51.32
X	145424	-0.221	-0.420	-0.638	0.335	0.879	4.473	4.706	3.786	53.43	104.91	51.35
	145536						4.764	5.045	4.045	58.07	113.99	55.69

Beam A-2 - August 15, 1991

Loc.	Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	Shear A/H - B/G	Load Mid	Shear C/F -D/E
	145616	0.000	0.000	0.000	0.000	0.000	4.965	5.254	4.217	60.43	118.62	57.97
A	150140	2.332	3.209	2.190	0.026	-0.241	5.029	5.295	4.251	58.82	115.47	56.55
B	150159	3.171	5.978	5.609	1.519	-0.118	5.040	5.297	4.255	58.81	115.43	56.53
C	150221	2.547	6.092	8.905	4.198	1.262	5.023	5.298	4.258	58.72	115.28	56.41
D	150242	0.836	4.241	9.023	5.596	2.165	5.031	5.299	4.254	58.69	115.19	56.39
E	150259	-0.314	1.695	5.750	4.900	2.653	5.035	5.300	4.256	58.64	115.09	56.32
F	150316	0.554	0.947	2.656	2.675	1.968	5.036	5.303	4.254	58.63	115.04	56.33
G	150343	0.011	-0.460	0.557	2.096	2.052	5.045	5.304	4.259	58.62	114.94	56.20
H	150404	-0.627	-0.805	3.708	5.770	4.051	5.047	5.305	4.249	58.59	114.90	56.19
I	150427	-0.960	1.815	8.972	8.290	4.525	5.044	5.306	4.256	58.50	114.72	56.10
J	150453	1.260	6.468	12.855	7.833	2.416	5.049	5.308	4.258	58.47	114.69	56.09
K	150516	3.799	8.895	11.838	5.113	0.958	5.054	5.309	4.258	58.41	114.57	56.03
L	150536	4.672	6.751	7.209	2.436	0.639	5.056	5.309	4.261	58.37	114.50	55.99
M	150609	2.130	4.025	4.825	1.651	0.098	5.057	5.312	4.266	58.37	114.47	56.00
N	150629	1.532	4.560	7.468	3.332	0.270	5.049	5.313	4.264	58.28	114.32	55.93
O	150654	0.025	2.781	7.264	5.238	1.963	5.058	5.313	4.265	58.26	114.32	55.92
R	150719	-0.361	-0.820	-0.219	0.848	1.389	5.061	5.317	4.275	58.14	114.10	55.84
S	150746	0.736	1.683	0.773	-1.111	-0.874	5.064	5.317	4.269	58.13	114.09	55.89
T	150814	-0.491	-3.834	-7.378	-4.005	-0.803	5.056	5.318	4.280	58.09	114.06	55.85
U	150841	-1.898	-4.478	-5.075	-1.266	0.654	5.064	5.319	4.280	58.01	113.91	55.78
X	150905	-1.311	-1.702	-1.355	0.451	1.010	5.058	5.319	4.285	58.00	113.88	55.75
	151020						5.408	5.737	4.598	63.22	124.11	60.70
	151058	0.000	0.000	0.000	0.000	0.000	5.652	5.979	4.807	65.82	129.21	63.21
A	151522	3.099	3.950	2.298	-0.231	-0.405	5.737	6.039	4.832	63.90	125.41	61.43
B	151542	4.051	7.601	6.891	1.512	-0.424	5.738	6.040	4.836	63.89	125.35	61.41
C	151604	2.836	7.548	11.129	4.798	1.108	5.735	6.042	4.837	63.77	125.13	61.28
D	151628	0.445	4.866	11.271	6.993	2.515	5.735	6.044	4.843	63.71	125.00	61.20
E	151656	-0.790	1.412	6.826	6.335	3.468	5.737	6.046	4.843	63.60	124.78	61.09
F	151720	0.239	0.550	2.734	3.231	2.390	5.743	6.048	4.847	63.50	124.60	61.00
G	151747	-0.027	-0.661	0.709	2.728	2.677	5.755	6.051	4.837	63.51	124.47	60.90
H	151809	-0.881	-1.259	4.244	6.882	4.940	5.757	6.054	4.841	63.42	124.36	60.83
I	151833	-1.321	2.016	10.345	9.611	4.846	5.764	6.057	4.844	63.34	124.18	60.76
J	151855	1.106	7.545	14.846	8.482	1.937	5.761	6.058	4.843	63.34	124.18	60.75
K	151919	4.387	10.629	12.946	4.714	0.449	5.767	6.060	4.844	63.27	124.05	60.68
L	151945	5.824	7.700	7.013	1.751	0.203	5.770	6.062	4.846	63.17	123.86	60.61
M	152014	2.611	4.937	5.484	1.547	-0.119	5.767	6.064	4.851	63.12	123.75	60.55
N	152036	1.580	5.784	9.082	3.635	-0.091	5.768	6.067	4.853	63.08	123.68	60.53
O	152056	-0.303	3.076	8.995	6.406	2.179	5.771	6.068	4.854	62.99	123.51	60.44
R	152120	-0.547	-1.265	-0.642	1.069	1.929	5.773	6.069	4.856	62.91	123.41	60.40
S	152145	0.784	1.806	0.344	-2.042	-1.560	5.777	6.073	4.861	62.83	123.31	60.43
T	152211	-1.235	-6.137	-10.231	-4.592	-0.299	5.772	6.073	4.856	62.81	123.25	60.37
U	152240	-3.322	-6.550	-6.326	-1.085	0.936	5.775	6.074	4.855	62.76	123.16	60.35
X	152304	-2.706	-2.988	-1.302	0.976	1.301	5.776	6.076	4.856	62.72	123.09	60.29
	152423						6.216	6.644	5.231	68.25	133.88	65.50

Beam A-2 - August 15, 1991

Loc. Time	Web out of plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
	Top	2	3	4	Bot.	A/H - B/G	Mid	C/F -D/E	Shear A/H - B/G	Load Mid	Shear C/F -D/E
152658						11.297	9.439	5.652	32.20	63.44	31.05
155306						2.950	2.409	1.563	0.16	0.56	0.18

Beam A-3 - August 16, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/C	Mid	C/F - D/E
	113041	0.000	0.000	0.000	0.000	0.000	0.000	-0.177	0.000	0.10	0.43	0.11
A	114553	1.080	1.487	1.909	1.315	0.632	0.124	-0.182	0.106	0.16	0.52	0.22
B	114610	0.646	1.117	1.378	0.799	0.317	0.153	-0.182	0.197	0.15	0.51	0.23
C	114624	0.595	0.871	1.264	0.526	0.193	0.138	-0.183	0.151	0.15	0.51	0.21
D	114645	0.675	1.074	1.379	0.786	0.395	0.152	-0.182	0.185	0.17	0.52	0.23
E	114702	0.466	0.981	1.051	0.599	0.295	0.147	-0.182	0.175	0.17	0.52	0.22
F	114719	0.688	0.860	1.219	0.552	0.319	0.147	-0.182	0.173	0.17	0.52	0.21
G	114742	0.387	0.757	0.926	0.903	0.452	0.126	-0.182	0.139	0.19	0.51	0.15
H	114800	0.443	0.773	1.235	0.797	0.485	0.138	-0.182	0.137	0.20	0.51	0.16
I	114817	0.586	1.137	1.477	0.818	0.434	0.095	-0.183	0.128	0.22	0.49	0.15
J	114839	0.837	1.414	-0.123	1.193	0.584	0.127	-0.183	0.141	0.25	0.50	0.15
K	114856	1.094	1.720	2.174	1.369	0.629	0.143	-0.183	0.131	0.22	0.51	0.16
L	114916	1.260	2.180	2.465	1.622	0.837	0.155	-0.183	0.150	0.23	0.52	0.16
M	114941	1.042	1.396	1.726	1.284	0.914	-0.057	-0.208	-0.078	0.21	0.49	0.14
N	115000	1.082	1.528	2.315	1.464	0.912	-0.127	-0.213	-0.127	0.23	0.51	0.16
O	115018	1.005	1.444	1.820	1.376	0.820	-0.086	-0.214	-0.113	0.20	0.50	0.15
R	115042	0.897	1.036	1.056	0.664	0.533	-0.065	-0.214	-0.089	0.21	0.49	0.15
S	115106	0.838	1.031	1.300	0.792	0.585	-0.138	-0.219	-0.241	0.16	0.51	0.22
T	115128	0.822	1.342	1.892	1.227	0.764	-0.098	-0.221	-0.205	0.17	0.54	0.23
U	115147	0.921	1.365	1.987	1.258	0.729	-0.107	-0.221	-0.213	0.16	0.54	0.24
X	115207	0.882	1.367	1.811	1.371	0.886	-0.056	-0.221	-0.118	0.15	0.52	0.25
	115343						0.247	0.012	0.218	2.66	5.39	2.54
	115439	0.000	0.000	0.000	0.000	0.000	0.514	0.214	0.540	5.18	10.25	4.89
A	120008	1.043	1.448	1.947	1.053	0.492	0.524	0.226	0.537	5.05	9.98	4.84
B	120024	0.724	1.217	1.591	0.896	0.283	0.523	0.226	0.555	5.04	9.96	4.81
C	120043	0.645	0.974	1.500	0.674	0.189	0.523	0.226	0.564	5.04	9.95	4.80
D	120102	0.646	0.987	1.427	0.665	0.159	0.516	0.226	0.578	5.02	9.90	4.78
E	120121	0.436	0.957	1.144	0.609	0.226	0.521	0.226	0.540	5.02	9.88	4.77
F	120140	0.662	0.869	1.132	0.639	0.275	0.523	0.226	0.549	5.02	9.88	4.75
G	120201	0.343	0.754	0.969	0.743	0.355	0.524	0.227	0.553	5.04	9.82	4.68
H	120219	0.514	0.841	1.432	0.811	0.480	0.521	0.227	0.551	5.04	9.83	4.69
I	120238	0.664	1.167	1.719	0.889	0.445	0.522	0.227	0.565	5.04	9.83	4.69
J	120302	0.909	1.562	0.147	1.146	0.466	0.525	0.227	0.565	5.02	9.80	4.67
K	120321	1.235	2.109	3.100	2.150	0.559	0.527	0.227	0.562	5.03	9.82	4.68
L	120343	1.354	2.275	2.700	1.763	0.801	0.529	0.227	0.564	5.03	9.82	4.68
M	120406	1.154	1.447	1.934	1.386	0.856	0.522	0.227	0.569	5.02	9.79	4.68
N	120423	1.159	1.601	2.483	1.502	0.826	0.523	0.227	0.573	5.01	9.81	4.69
O	120442	0.921	1.352	0.952	1.301	0.714	0.520	0.227	0.553	4.98	9.74	4.66
R	120503	0.827	0.929	1.087	0.521	0.352	0.523	0.227	0.567	4.99	9.79	4.70
S	120524	0.816	1.070	1.420	0.868	0.579	0.525	0.227	0.546	4.93	9.76	4.73
T	120545	0.864	1.378	1.982	1.183	0.694	0.527	0.227	0.542	4.92	9.75	4.72
U	120604	1.009	1.430	2.133	1.333	0.707	0.529	0.227	0.549	4.91	9.73	4.69
X	120621	0.915	1.371	1.951	1.433	0.962	0.528	0.227	0.550	4.90	9.71	4.70
	120736						0.694	0.407	0.710	7.66	15.09	7.27

Beam A-3 - August 16, 1991

											Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	120809	0.000	0.000	0.000	0.000	0.000	0.915	0.610	0.985	10.20	20.08	9.71
A	121316	1.114	1.440	1.897	1.130	0.310	0.917	0.616	1.045	9.94	19.57	9.51
B	121333	0.794	1.356	1.783	1.040	0.420	0.916	0.616	1.046	9.94	19.56	9.52
C	121402	0.820	1.164	1.764	0.835	0.338	0.875	0.616	0.910	9.93	19.53	9.49
D	121422	0.699	1.165	1.532	0.954	0.500	0.874	0.616	0.906	9.91	19.48	9.47
E	121437	0.538	1.168	1.215	0.807	0.440	0.876	0.616	0.887	9.90	19.45	9.45
F	121455	0.757	0.949	1.394	0.744	0.405	0.879	0.617	0.880	9.93	19.51	9.47
G	121515	0.419	0.929	1.076	0.957	0.559	0.879	0.617	0.889	9.96	19.46	9.40
H	121536	0.510	0.960	1.576	1.117	0.779	0.874	0.617	0.918	9.99	19.52	9.43
I	121558	0.618	1.281	1.852	1.142	0.575	0.883	0.617	0.885	9.97	19.52	9.42
J	121617	1.021	1.620	-0.138	1.498	0.722	0.876	0.617	0.891	9.99	19.52	9.42
K	121635	1.207	1.975	2.576	1.632	0.813	0.880	0.617	0.901	9.94	19.48	9.40
L	121658	1.395	2.319	2.652	1.731	0.996	0.875	0.617	0.934	9.92	19.43	9.39
M	121722	1.056	1.459	1.800	1.329	0.940	0.884	0.617	0.930	9.94	19.42	9.39
N	121738	1.075	1.590	2.404	1.577	0.950	0.876	0.617	0.932	9.94	19.43	9.39
O	121752	0.948	1.375	0.840	1.359	0.811	0.881	0.617	0.925	9.90	19.39	9.38
R	121811	0.918	1.048	1.114	0.597	0.253	0.888	0.617	0.921	9.89	19.40	9.39
S	121834	0.877	1.174	1.434	0.993	0.493	0.882	0.619	0.946	9.87	19.42	9.49
T	121856	0.973	1.448	1.925	1.304	0.793	0.882	0.620	0.909	9.88	19.46	9.47
U	121916	0.981	1.428	2.106	1.474	0.888	0.883	0.620	0.946	9.85	19.44	9.44
X	121939	0.962	1.433	2.002	1.558	1.136	0.882	0.620	0.934	9.87	19.45	9.44
	122447						1.099	0.933	1.198	12.75	25.12	12.18
	122515	0.000	0.000	0.000	0.000	0.000	1.251	1.094	1.345	15.11	29.76	14.47
A	123020	1.080	1.474	2.021	1.313	0.673	1.214	1.076	1.284	14.78	29.10	14.22
B	123041	0.702	1.398	1.904	1.181	0.441	1.212	1.076	1.284	14.81	29.13	14.22
C	123109	0.775	1.250	1.945	0.961	0.382	1.215	1.076	1.271	14.78	29.08	14.19
D	123130	0.751	1.208	1.834	1.071	0.521	1.250	1.076	1.172	14.75	29.02	14.15
E	123148	0.527	1.011	1.354	0.872	0.458	1.251	1.076	1.177	14.80	29.11	14.18
F	123207	0.725	0.914	1.403	0.768	0.376	1.236	1.077	1.124	14.78	29.05	14.16
G	123230	0.356	0.699	1.095	0.992	0.552	1.262	1.078	1.232	14.81	29.02	14.09
H	123253	0.484	0.971	1.571	1.116	0.605	1.221	1.078	1.297	14.83	29.02	14.09
I	123310	0.661	1.338	1.959	1.136	0.560	1.220	1.078	1.253	14.81	29.03	14.08
J	123330	1.108	1.888	0.399	1.810	0.823	1.229	1.078	1.221	14.78	28.98	14.06
K	123347	1.145	2.046	2.763	1.752	0.879	1.236	1.078	1.201	14.82	29.01	14.07
L	123404	1.415	2.412	2.736	1.824	1.054	1.248	1.077	1.199	14.79	28.99	14.07
M	123430	1.151	1.652	2.116	1.692	1.067	1.224	1.077	1.207	14.76	28.95	14.06
N	123458	1.029	1.508	2.314	1.321	0.767	1.220	1.077	1.254	14.76	28.93	14.05
O	123521	0.869	1.230	0.777	1.378	0.809	1.228	1.077	1.233	14.73	28.90	14.05
R	123545	0.864	0.915	1.044	0.492	0.257	1.220	1.076	1.273	14.70	28.87	14.04
S	123608	0.819	1.155	1.433	0.982	0.498	1.221	1.076	1.267	14.67	28.90	14.09
T	123631	0.880	1.364	1.951	1.336	0.850	1.222	1.077	1.281	14.66	28.87	14.11
U	123656	0.958	1.450	2.086	1.348	0.760	1.222	1.076	1.270	14.67	28.88	14.09
X	123723	1.046	1.346	1.892	1.376	0.945	1.230	1.076	1.294	14.67	28.90	14.10
	124348						1.394	1.285	1.446	17.72	34.92	16.99

Beam A-3 - August 16, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - 3/G	Mid	C/F - D/E
	124418	0.000	0.000	0.000	0.000	0.000	1.538	1.447	1.577	20.11	39.64	19.31
A	125217	1.146	1.622	2.218	1.252	0.652	1.574	1.438	1.653	19.67	38.78	18.94
B	125239	0.886	1.558	2.237	1.289	0.438	1.559	1.438	1.647	19.66	38.74	18.93
C	125302	0.841	1.378	2.231	1.188	0.452	1.567	1.438	1.651	19.62	38.65	18.89
D	125324	0.662	1.255	1.902	1.126	0.543	1.564	1.439	1.653	19.65	38.71	18.88
E	125350	0.448	1.113	1.446	0.935	0.462	1.572	1.439	1.647	19.63	38.66	18.86
F	125411	0.696	0.861	1.535	0.852	0.437	1.569	1.439	1.656	19.61	38.61	18.84
G	125431	0.398	0.717	1.213	1.040	0.514	1.568	1.439	1.648	19.68	38.65	18.81
H	125454	0.485	0.936	1.782	1.228	0.625	1.568	1.439	1.651	19.70	38.61	18.79
I	125518	0.669	1.393	2.262	1.293	0.621	1.562	1.439	1.619	19.66	38.55	18.76
J	125545	1.197	1.949	0.542	1.709	0.640	1.568	1.439	1.634	19.69	38.62	18.79
K	125605	1.195	2.086	2.957	1.786	0.745	1.575	1.439	1.628	19.67	38.61	18.78
L	125626	1.433	2.318	2.872	1.799	0.923	1.571	1.439	1.637	19.65	38.56	18.76
M	125654	1.122	1.440	1.900	1.325	0.814	1.571	1.439	1.623	19.60	38.51	18.75
N	125716	0.998	1.461	2.417	1.576	0.860	1.565	1.438	1.634	19.61	38.52	18.77
O	125735	0.918	1.202	1.254	1.540	0.758	1.575	1.438	1.631	19.60	38.51	18.76
R	125757	0.801	0.825	0.975	0.459	0.187	1.572	1.438	1.656	19.54	38.43	18.74
S	125818	0.861	1.062	1.520	1.036	0.410	1.431	1.438	1.649	19.53	38.51	18.80
T	125840	0.983	1.395	2.082	1.388	0.644	1.431	1.438	1.652	19.51	38.46	18.81
U	125900	0.984	1.418	2.162	1.476	0.787	1.434	1.437	1.657	19.50	38.44	18.78
X	125929	0.929	1.222	1.910	1.417	0.916	1.441	1.437	1.645	19.49	38.42	18.77
	130039						1.604	1.672	1.825	22.79	44.96	21.92
	130129	0.000	0.000	0.000	0.000	0.000	1.770	1.854	1.981	25.18	49.67	24.25
A	130803	1.229	1.821	2.504	1.636	0.614	1.777	1.858	2.011	24.68	48.68	23.82
B	130821	0.849	1.701	2.482	1.367	0.467	1.779	1.858	2.013	24.66	48.65	23.78
C	130909	0.816	1.450	2.448	1.285	0.496	1.778	1.859	2.013	24.64	48.57	23.74
D	130926	0.641	1.321	2.073	1.324	0.622	1.783	1.860	2.012	24.63	48.53	23.76
E	130949	0.375	1.152	1.541	1.037	0.544	1.783	1.861	2.015	24.66	48.58	23.76
F	131006	0.655	0.831	1.460	0.834	0.461	1.787	1.862	2.016	24.68	48.62	23.78
G	131035	0.259	0.872	1.131	0.980	0.447	1.782	1.863	2.016	24.71	48.57	23.68
H	131058	0.379	0.974	1.792	1.342	0.635	1.787	1.863	2.018	24.67	48.50	23.65
I	131120	0.658	1.552	2.491	1.478	0.711	1.788	1.863	2.022	24.67	48.47	23.63
J	131142	1.123	2.104	1.068	1.816	0.970	1.788	1.863	2.016	24.64	48.46	23.63
K	131204	1.307	2.369	3.214	1.928	0.950	1.796	1.863	2.015	24.63	48.44	23.63
L	131226	1.471	2.547	2.911	1.796	0.992	1.784	1.863	2.013	24.61	48.39	23.59
M	131255	1.010	1.629	1.895	1.414	0.951	1.787	1.864	2.016	24.59	48.38	23.59
N	131314	0.940	1.534	2.401	1.539	0.863	1.793	1.864	2.017	24.60	48.37	23.59
O	131340	0.762	1.025	0.172	1.314	0.761	1.790	1.864	2.027	24.55	48.28	23.58
R	131405	0.845	0.903	1.010	0.514	0.289	1.808	1.864	2.029	24.51	48.27	23.57
S	131430	0.878	1.204	1.584	0.942	0.618	1.811	1.864	2.032	24.50	48.33	23.65
T	131452	1.014	1.557	2.110	1.405	0.797	1.793	1.864	2.028	24.48	48.30	23.60
U	131515	1.044	1.483	2.107	1.444	0.834	1.797	1.864	2.026	24.45	48.26	23.59
X	131539	0.832	1.260	1.811	1.315	0.907	1.795	1.864	2.031	24.43	48.24	23.59
	131710						1.999	2.071	2.118	27.62	54.52	26.61

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												Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	131738	0.000	0.000	0.000	0.000	0.000	2.116	2.270	2.348	30.24	59.72	29.17
A	132308	1.201	1.617	2.455	1.272	0.524	2.143	2.272	2.379	29.72	58.66	28.74
B	132329	0.866	1.768	2.774	1.515	0.525	2.150	2.273	2.381	29.69	58.60	28.69
C	132348	0.865	1.535	2.726	1.384	0.490	2.150	2.273	2.378	29.66	58.53	28.65
D	132413	0.689	1.368	2.472	1.535	0.683	2.148	2.273	2.380	29.65	58.49	28.63
E	132433	0.378	0.917	1.687	1.155	0.607	2.142	2.273	2.378	29.63	58.44	28.59
F	132452	0.740	0.684	1.447	0.837	0.403	2.145	2.275	2.377	29.63	58.42	28.59
G	132515	0.329	0.858	1.286	1.080	0.506	2.149	2.276	2.374	29.69	58.39	28.50
H	132534	0.470	1.108	2.168	1.434	0.598	2.155	2.276	2.381	29.70	58.40	28.52
I	132550	0.767	1.707	2.850	1.705	0.748	2.147	2.276	2.384	29.67	58.36	28.49
J	132618	1.344	2.299	1.512	1.891	0.888	2.152	2.276	2.378	29.67	58.41	28.50
K	132640	1.430	2.480	3.511	1.862	0.762	2.156	2.276	2.380	29.67	58.37	28.49
L	132656	1.602	2.596	3.064	1.728	0.894	2.155	2.276	2.377	29.65	58.37	28.50
M	132727	1.086	1.412	1.821	1.309	0.894	2.157	2.275	2.378	29.60	58.32	28.48
N	132749	0.940	1.352	2.220	1.351	0.774	2.154	2.275	2.385	29.55	58.23	28.45
O	132813	0.766	0.916	0.863	1.276	0.750	2.152	2.275	2.386	29.55	58.25	28.45
R	132841	0.881	0.630	0.831	0.363	0.243	2.151	2.275	2.375	29.48	58.14	28.43
S	132909	0.717	0.925	1.435	0.855	0.648	2.170	2.275	2.397	29.45	58.17	28.48
T	132930	0.958	1.549	2.061	1.358	0.909	2.159	2.276	2.387	29.43	58.13	28.46
U	132952	1.079	1.398	2.165	1.383	0.847	2.159	2.276	2.394	29.43	58.14	28.44
X	133022	1.009	1.248	1.922	1.260	0.876	2.154	2.275	2.391	29.41	58.09	28.45
	133302						2.345	2.491	2.560	32.79	64.78	31.66
	133335	0.000	0.000	0.000	0.000	0.000	2.492	2.658	2.698	35.20	69.56	34.02
A	133909	1.154	1.978	2.684	1.451	0.645	2.513	2.661	2.716	34.55	68.25	33.44
B	133925	0.912	2.011	3.105	1.583	0.398	2.510	2.661	2.721	34.54	68.20	33.41
C	133949	0.912	1.945	3.433	1.767	0.626	2.514	2.661	2.720	34.52	68.14	33.39
D	134015	0.587	1.518	2.826	1.879	0.907	2.512	2.661	2.716	34.52	68.19	33.37
E	134036	0.260	0.967	1.936	1.484	0.821	2.516	2.661	2.721	34.47	68.06	33.31
F	134053	0.649	0.751	1.527	0.927	0.504	2.517	2.662	2.720	34.47	68.04	33.31
G	134118	0.314	0.852	1.474	1.249	0.577	2.505	2.661	2.716	34.52	68.02	33.25
H	134135	0.353	1.216	2.475	1.713	0.784	2.506	2.661	2.727	34.49	68.00	33.23
I	134152	0.638	1.974	3.348	2.054	0.907	2.519	2.661	2.726	34.48	67.95	33.21
J	134216	1.372	2.583	2.211	2.157	0.978	2.515	2.661	2.714	34.48	67.99	33.23
K	134235	1.630	2.919	4.028	2.130	0.920	2.522	2.662	2.728	34.45	67.93	33.21
L	134257	1.729	2.875	3.301	1.894	1.060	2.522	2.662	2.727	34.41	67.88	33.18
M	134323	0.935	1.391	1.795	1.345	0.871	2.515	2.662	2.719	34.40	67.85	33.16
N	134344	0.688	1.286	2.223	1.383	0.874	2.513	2.662	2.724	34.42	67.85	33.19
O	134403	0.514	0.735	0.689	1.314	0.757	2.517	2.662	2.718	34.41	67.83	33.18
R	134427	0.734	0.791	0.889	0.393	0.330	2.527	2.662	2.727	34.35	67.78	33.18
S	134455	0.597	1.006	1.433	0.834	0.683	2.541	2.662	2.782	34.28	67.75	33.19
T	134518	0.875	1.610	2.162	1.345	0.840	2.541	2.662	2.781	34.27	67.73	33.19
U	134538	0.945	1.370	2.156	1.284	0.679	2.541	2.663	2.775	34.24	67.67	33.16
X	134600	0.966	1.324	1.982	1.203	0.818	2.544	2.676	2.779	34.29	67.75	33.18
	134733						2.764	2.890	2.956	37.65	74.40	36.39

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	134811	0.000	0.000	0.000	0.000	0.000	2.923	3.078	3.108	40.15	79.37	38.83
A	135324	1.356	2.212	2.967	1.514	0.660	2.942	3.086	3.116	39.43	77.92	38.16
B	135344	1.113	2.544	3.865	1.982	0.552	2.938	3.086	3.118	39.40	77.85	38.13
C	135403	1.173	2.469	4.448	2.588	0.973	2.932	3.086	3.125	39.38	77.82	38.10
D	135426	0.523	1.648	3.516	2.318	1.113	2.936	3.087	3.119	39.37	77.76	38.07
E	135445	0.184	1.000	2.218	1.862	1.070	2.942	3.086	3.119	39.34	77.72	38.04
F	135503	0.630	0.713	1.604	1.138	0.593	2.949	3.086	3.120	39.31	77.62	38.01
G	135531	0.246	0.786	1.550	1.416	0.667	2.948	3.087	3.120	39.36	77.63	37.96
H	135552	0.273	1.255	2.930	2.285	1.190	2.941	3.087	3.122	39.34	77.57	37.93
I	135612	0.744	2.342	4.208	2.601	1.082	2.949	3.088	3.118	39.36	77.63	37.96
J	135641	1.595	3.174	4.913	2.621	1.029	2.946	3.088	3.128	39.28	77.43	37.86
K	135701	1.821	3.451	4.618	2.315	0.900	2.938	3.088	3.126	39.28	77.45	37.87
L	135722	1.878	3.108	3.503	1.920	1.066	2.951	3.088	3.121	39.22	77.37	37.82
M	135753	0.969	1.386	1.914	1.442	0.961	2.944	3.088	3.125	39.19	77.32	37.83
N	135810	0.569	1.035	2.139	1.576	0.967	2.940	3.088	3.127	39.17	77.28	37.81
O	135836	0.350	0.415	0.854	1.385	0.897	2.951	3.088	3.124	39.17	77.29	37.82
R	135857	0.818	0.669	0.751	0.282	0.205	2.949	3.088	3.125	39.13	77.25	37.83
S	135930	0.705	0.987	1.635	1.059	0.755	2.966	3.088	3.121	39.05	77.16	37.88
T	135956	1.253	1.769	2.416	1.532	0.935	2.933	3.088	3.121	39.04	77.17	37.81
U	140021	1.078	1.664	2.476	1.525	0.835	2.935	3.088	3.124	39.01	77.10	37.78
X	140050	1.158	1.429	2.105	1.299	0.967	2.939	3.088	3.135	38.99	77.06	37.74
	140833						3.155	3.347	3.165	42.68	84.35	41.27
	140904	0.000	0.000	0.000	0.000	0.000	3.306	3.522	3.318	45.21	89.34	43.72
A	141544	1.534	2.436	3.252	1.552	0.618	3.359	3.523	3.450	44.30	87.51	42.86
B	141605	1.374	3.040	4.685	2.355	0.614	3.359	3.523	3.447	44.31	87.52	42.86
C	141624	1.124	2.764	5.237	2.899	0.767	3.354	3.523	3.435	44.27	87.45	42.83
D	141644	0.549	1.949	4.429	3.107	1.674	3.358	3.524	3.444	44.26	87.40	42.79
E	141704	-0.001	0.851	2.673	2.363	1.366	3.357	3.525	3.440	44.22	87.33	42.74
F	141727	0.493	0.506	1.347	1.248	0.763	3.362	3.525	3.454	44.24	87.32	42.76
G	141754	0.100	0.561	1.688	1.672	0.772	3.364	3.525	3.437	44.25	87.24	42.67
H	141813	0.100	1.367	3.625	2.900	1.479	3.349	3.525	3.353	44.20	87.19	42.65
I	141835	0.733	2.747	5.401	3.502	1.550	3.360	3.525	3.427	44.20	87.18	42.63
J	141900	1.897	3.921	3.878	3.205	1.180	3.367	3.525	3.450	44.20	87.14	42.62
K	141925	2.279	4.193	5.457	2.518	0.963	3.366	3.525	3.453	44.16	87.08	42.59
L	141950	2.200	3.379	3.807	1.843	1.100	3.369	3.525	3.446	44.15	87.08	42.59
M	142017	0.716	1.148	1.827	1.610	1.059	3.363	3.525	3.427	44.10	86.98	42.55
N	142038	0.147	0.491	1.815	1.578	1.175	3.367	3.525	3.456	44.08	86.96	42.55
O	142110	-0.132	-0.563	-1.213	1.118	0.869	3.367	3.525	3.444	44.07	86.90	42.53
R	142135	0.782	0.464	0.328	0.017	0.068	3.350	3.526	3.472	43.99	86.81	42.51
S	142206	0.615	0.920	1.597	1.044	0.873	3.366	3.527	3.457	43.93	86.79	42.57
T	142229	1.155	1.790	2.596	1.629	0.953	3.369	3.527	3.450	43.94	86.82	42.57
U	142315	1.256	1.645	2.475	1.486	0.807	3.357	3.527	3.412	43.92	86.76	42.55
X	142338	1.052	1.388	2.121	1.358	0.875	3.368	3.527	3.444	43.87	86.66	42.48
	142452						3.623	3.772	3.722	47.72	94.27	46.12

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN) Shear	Forces (kN) Load	Forces (kN) Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
	142634	0.000	0.000	0.000	0.000	0.000	3.821	3.991	3.908	50.23	99.22	48.53
A	143511	1.823	3.076	3.800	1.567	0.512	3.825	3.996	3.851	49.12	97.02	47.51
B	143530	1.795	3.946	5.746	2.649	0.513	3.829	3.996	3.870	49.06	96.87	47.44
C	143556	1.280	3.577	6.623	3.764	1.293	3.831	3.996	3.871	49.01	96.77	47.38
D	143616	0.272	2.253	5.461	4.046	1.912	3.831	3.997	3.872	49.04	96.85	47.40
E	143640	-0.106	1.090	4.057	3.993	1.799	3.835	3.997	3.875	48.99	96.70	47.35
F	143657	0.385	0.475	1.752	1.511	0.923	3.829	3.997	3.861	49.00	96.70	47.34
G	143727	0.175	0.826	2.476	2.699	1.107	3.838	3.998	3.878	49.00	96.60	47.24
H	143751	-0.262	1.488	4.571	3.887	1.922	3.839	3.998	3.878	48.99	96.59	47.24
I	143815	0.647	3.489	7.094	4.529	1.857	3.841	3.998	3.880	48.93	96.48	47.19
J	143846	2.420	5.282	7.866	4.001	1.338	3.841	3.998	3.878	48.92	96.45	47.19
K	143903	2.892	5.345	6.559	2.728	0.865	3.842	3.998	3.877	48.88	96.39	47.14
L	143922	2.692	4.119	4.158	1.836	0.952	3.844	3.998	3.882	48.86	96.36	47.13
M	143952	0.049	0.537	1.488	1.762	1.047	3.844	3.998	3.879	48.83	96.31	47.12
N	144009	-0.786	-0.843	0.645	1.544	1.357	3.845	3.998	3.883	48.79	96.27	47.11
O	144031	-0.947	-2.286	-2.060	0.646	0.862	3.845	3.998	3.884	48.79	96.27	47.11
R	144055	0.880	0.452	-0.357	-0.486	-0.173	3.856	3.998	3.884	48.75	96.23	47.11
S	144125	0.532	0.904	1.683	1.217	0.790	3.848	4.000	3.884	48.71	96.20	47.16
T	144145	1.347	2.453	3.270	1.850	0.949	3.854	4.000	3.888	48.66	96.11	47.08
U	144207	1.408	2.040	2.861	1.615	0.753	3.854	4.000	3.888	48.66	96.11	47.07
X	144234	1.193	1.646	2.303	1.446	0.955	3.854	4.000	3.888	48.64	96.08	47.05
	144549						4.107	4.306	4.187	52.93	104.57	51.13
	144612	0.000	0.000	0.000	0.000	0.000	4.299	4.510	4.297	55.37	109.42	53.51
A	145527	2.217	3.645	4.404	1.771	0.411	4.347	4.523	4.310	53.75	106.26	52.05
B	145544	2.128	4.770	6.854	2.934	0.320	4.351	4.524	4.363	53.71	106.18	51.99
C	145605	1.383	4.274	8.178	4.372	1.262	4.349	4.524	4.370	53.71	106.16	51.98
D	145628	-0.088	2.353	6.592	4.887	2.227	4.348	4.524	4.367	53.65	106.02	51.92
E	145649	-0.786	0.357	3.468	3.693	2.024	4.366	4.525	4.366	53.65	106.00	51.90
F	145715	0.261	0.262	1.605	2.093	1.114	4.346	4.525	4.294	53.58	105.87	51.83
G	145736	-0.266	0.322	2.118	2.645	1.432	4.359	4.525	4.327	53.62	105.81	51.78
H	145754	-0.643	1.298	5.609	4.968	2.344	4.354	4.525	4.300	53.60	105.78	51.77
I	145815	0.409	3.939	8.969	5.787	2.141	4.345	4.525	4.363	53.58	105.79	51.76
J	145837	2.857	6.375	9.698	4.514	1.204	4.353	4.525	4.308	53.56	105.73	51.73
K	145856	3.578	6.684	7.674	2.785	0.638	4.362	4.525	4.327	53.52	105.67	51.69
L	145913	3.318	4.632	4.315	1.678	0.797	4.357	4.525	4.362	53.48	105.58	51.66
M	145941	-0.970	-0.529	0.953	1.957	1.305	4.377	4.526	4.370	53.46	105.57	51.66
N	150011	-2.340	-3.190	-1.205	1.250	1.333	4.364	4.527	4.376	53.42	105.49	51.62
O	150028	-1.896	-4.782	-4.857	-0.295	0.668	4.369	4.527	4.328	53.40	105.49	51.63
R	150052	1.208	0.563	-0.785	-1.072	-0.355	4.376	4.528	4.337	53.34	105.39	51.60
S	150119	0.453	0.810	2.021	1.592	0.998	4.356	4.529	4.185	53.26	105.29	51.61
T	150136	1.865	3.404	4.651	2.368	0.936	4.368	4.529	4.330	53.28	105.32	51.61
U	150155	1.850	2.848	3.633	1.669	0.546	4.363	4.529	4.308	53.25	105.29	51.60
X	150217	1.523	1.856	2.388	1.193	0.542	4.369	4.529	4.332	53.22	105.20	51.56
	150314						4.677	4.845	4.627	57.75	114.20	55.88

Beam A-3 - August 16, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Detlection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load Mid	Shear C/F - D/E
	150400	0.000	0.000	0.000	0.000	0.000	4.873	5.089	4.795	60.26	119.21	58.33
A	151653	2.629	4.209	4.751	1.377	0.264	4.969	5.141	4.849	57.85	114.50	56.17
B	151711	2.543	5.839	7.990	3.132	0.256	4.958	5.141	4.842	57.83	114.46	56.13
C	151732	1.377	5.048	9.711	5.062	1.448	4.964	5.142	4.844	57.80	114.38	56.08
D	151753	-0.490	2.480	7.814	5.919	2.778	4.965	5.142	4.847	57.79	114.38	56.07
E	151816	-1.180	0.071	4.003	4.467	2.747	4.967	5.143	4.847	57.76	114.31	56.03
F	151834	0.147	-0.017	1.635	2.023	1.397	4.961	5.143	4.845	57.71	114.21	55.98
G	151859	-0.371	0.124	2.593	3.633	1.941	4.961	5.144	4.853	57.74	114.19	55.94
H	151927	-1.254	1.034	6.611	6.141	3.065	4.968	5.144	4.854	57.69	114.13	55.90
I	151951	0.051	4.592	11.170	6.986	2.516	4.969	5.145	4.853	57.68	114.10	55.90
J	152015	2.807	7.965	11.826	5.131	1.334	4.966	5.145	4.848	57.65	114.02	55.85
K	152040	4.567	8.223	8.707	2.734	0.552	4.974	5.146	4.854	57.61	113.99	55.82
L	152101	4.206	5.315	4.437	1.290	0.659	4.977	5.146	4.854	57.59	113.92	55.79
M	152132	-2.211	-1.259	0.649	2.058	1.556	4.974	5.147	4.853	57.58	113.88	55.78
N	152153	-3.922	-5.230	-2.495	1.236	1.805	4.986	5.149	4.855	57.52	113.77	55.75
O	152222	-2.640	-6.772	-8.091	-0.879	1.339	4.982	5.149	4.851	57.50	113.75	55.73
R	152255	1.430	0.687	-1.429	-2.123	-1.379	5.009	5.150	4.860	57.46	113.68	55.72
S	152322	0.585	1.103	3.042	2.712	2.096	5.001	5.152	4.856	57.39	113.58	55.74
T	152345	2.496	5.499	7.335	3.256	1.134	5.005	5.152	4.860	57.37	113.55	55.71
U	152412	2.774	4.621	5.070	1.678	0.370	4.998	5.152	4.859	57.35	113.53	55.72
X	152432	2.149	2.843	2.712	0.924	0.421	5.003	5.153	4.860	57.33	113.50	55.66
	152554						5.364	5.568	5.186	62.79	124.41	60.94
	152706	0.000	0.000	0.000	0.000	0.000	5.559	5.810	5.254	65.31	129.45	63.44
A	153410	3.124	4.944	5.065	1.345	0.361	5.671	5.870	5.398	63.04	125.11	61.47
B	153428	3.003	6.923	8.966	3.187	-0.061	5.681	5.871	5.384	62.99	125.00	61.40
C	153448	1.250	5.798	11.275	5.711	1.364	5.681	5.873	5.366	62.95	124.92	61.35
D	153513	-1.204	2.518	8.851	6.925	2.976	5.685	5.875	5.375	62.88	124.77	61.28
E	153533	-1.708	-0.568	4.284	5.221	3.308	5.685	5.877	5.351	62.86	124.74	61.25
F	153554	-0.052	-0.343	1.488	2.354	1.772	5.689	5.879	5.353	62.77	124.56	61.17
G	153621	-0.740	-0.846	2.265	4.071	2.366	5.694	5.881	5.352	62.75	124.44	61.08
H	153640	-1.932	0.559	7.470	7.668	3.741	5.696	5.883	5.380	62.71	124.38	61.05
I	153700	-0.539	4.905	13.275	8.283	2.724	5.698	5.886	5.342	62.74	124.42	61.08
J	153725	3.005	9.630	13.494	5.802	1.046	5.701	5.888	5.359	62.62	124.18	60.96
K	153806	5.365	9.920	9.323	2.351	0.141	5.706	5.891	5.338	62.60	124.07	60.92
L	153825	5.192	5.980	4.110	0.882	0.472	5.709	5.891	5.343	62.51	123.98	60.86
M	153854	-4.557	-1.958	0.787	2.509	1.768	5.713	5.892	5.383	62.45	123.89	60.81
N	153913	-5.898	-7.598	-3.900	1.099	1.870	5.717	5.893	5.346	62.43	123.86	60.81
O	153940	-3.542	-9.546	-11.537	-2.033	0.727	5.746	5.896	5.453	62.37	123.71	60.76
R	154005	1.787	1.000	-1.942	-3.101	-1.962	5.733	5.898	5.370	62.29	123.61	60.71
S	154031	0.267	0.559	2.800	2.900	2.044	5.729	5.899	5.428	62.22	123.53	60.74
T	154056	3.021	7.429	10.004	4.112	1.095	5.729	5.900	5.413	62.18	123.49	60.68
U	154114	3.891	6.522	6.334	1.469	-0.027	5.732	5.901	5.412	62.13	123.39	60.65
X	154134	3.149	3.412	2.673	0.569	0.225	5.731	5.902	5.388	62.14	123.39	60.66
	154236						5.923	6.151	5.578	65.04	129.18	63.44

Beam A-3 - August 16, 1991

Loc. Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
									Shear	Load	Shear
	Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G	Mid	C/F - D/E
154257						6.135	6.352	5.812	67.40	133.84	65.73
154415						6.288	6.536	5.904	68.64	136.42	67.03
154437						6.467	6.688	6.069	69.79	138.74	68.18
154759						6.848	7.036	6.282	69.86	139.00	68.40
155457						11.962	9.582	6.211	29.25	58.65	28.72

Beam B-1 - November 18, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	Shear A/F - B/E	Load Mid	Shear B/E - C/D
	154348	0.000	0.000	0.000	0.000	0.000	0.000		0.000	-0.02	0.03	0.05
1	155000	1.352	1.491	1.758	0.083	1.725	0.137		0.173	0.15	0.30	0.15
2	155008	1.217	2.144	2.571	1.608	1.498	0.138		0.171	0.16	0.31	0.15
3	155024	1.236	2.411	2.745	1.821	1.367	0.138		0.170	0.16	0.31	0.15
4	155040	1.407	2.364	2.708	2.261	1.223	0.138		0.170	0.16	0.31	0.15
5	155052	1.403	2.430	2.354	0.983	0.945	0.136		0.171	0.16	0.32	0.16
6	155105	1.492	2.094	2.038	-1.477	1.047	0.138		0.171	0.16	0.32	0.16
7	155119	1.651	2.229	2.134	2.840	1.228	0.138		0.173	0.15	0.31	0.16
8	155134	1.708	2.164	2.119	-0.244	0.932	0.138		0.173	0.15	0.31	0.16
9	155150	1.896	2.246	1.965	-1.320	1.238	0.138		0.173	0.15	0.32	0.17
10	155207	1.439	1.903	1.999	-0.299	1.112	0.138		0.174	0.13	0.32	0.19
11	155234	1.376	1.972	2.167	-1.116	1.297	0.128		0.173	0.13	0.32	0.19
12	155250	1.089	1.738	2.009	3.046	0.911	0.129		0.174	0.13	0.32	0.19
13	155308	1.258	1.838	2.245	-0.169	1.070	0.130		0.174	0.12	0.31	0.19
14	155326	1.262	2.241	2.664	0.653	1.062	0.130		0.176	0.12	0.31	0.19
15	155342	1.290	2.420	2.848	2.126	1.215	0.128		0.171	0.12	0.32	0.20
16	155401	1.721	2.668	2.848	1.252	1.330	0.128		0.175	0.12	0.32	0.20
17	155423	1.768	2.485	2.792	-1.931	1.319	0.130		0.175	0.11	0.31	0.20
18	155440	1.540	2.038	2.259	-1.536	1.475	0.130		0.176	0.11	0.31	0.20
19	155508	0.426	0.505	0.402	-3.058	0.062	0.129		0.174	0.17	0.32	0.15
20	155527	0.150	0.351	0.508	1.992	0.073	0.129		0.175	0.17	0.32	0.15
21	155549	-0.202	0.105	0.214	-0.958	0.229	0.125		0.173	0.15	0.30	0.15
22	155609	-0.438	-0.200	-0.225	0.972	0.025	0.124		0.174	0.14	0.29	0.15
23	155627	-0.411	-0.676	-0.661	-0.248	-0.344	0.123		0.172	0.14	0.29	0.15
24	155649	-0.290	-0.877	-1.020	1.450	-0.839	0.125		0.173	0.15	0.30	0.15
25	155727	-0.748	-1.193	-0.742	2.029	-0.729	0.123		0.172	0.15	0.31	0.16
26	155745	-0.747	-1.147	-1.066	2.739	-0.414	0.124		0.172	0.15	0.32	0.17
27	155804	-0.670	-0.862	-0.768	1.226	-0.272	0.123		0.173	0.14	0.31	0.17
28	155825	-0.342	-0.366	-0.477	0.291	-0.376	0.124		0.174	0.11	0.30	0.19
29	155848	-0.667	-0.735	-0.753	0.131	-0.582	0.125		0.171	0.12	0.31	0.19
30	155907	-0.285	-0.581	-0.535	-0.898	-0.491	0.121		0.146	0.12	0.32	0.20
31	155927	-0.159	-0.498	-0.412	-2.351	-0.414	0.122		0.146	0.12	0.33	0.21
32	155950	-0.278	-0.502	-0.390	-0.214	-0.316	0.121		0.144	0.11	0.32	0.21
33	160009	-0.596	-0.593	-0.460	-0.671	-0.483	0.121		0.146	0.11	0.31	0.20
34	160026	-0.319	-0.320	-0.303	-1.026	-0.489	0.122		0.144	0.11	0.31	0.20
35	160040	-0.094	-0.083	-0.056	-1.419	-0.406	0.122		0.143	0.11	0.33	0.22
36	160100	-0.009	0.138	0.037	2.719	-0.110	0.121		0.145	0.11	0.33	0.22
	160334	0.000	0.000	0.000	0.000	0.000	0.342		0.289	2.34	4.83	2.49
	160358	-0.007	-0.002	-0.003	1.029	0.005	0.643		0.510	5.10	10.52	5.42
	160524	-0.020	-0.007	-0.008	0.425	0.000	0.953		0.877	7.52	15.32	7.80

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	160640	1.051	1.439	1.698	1.795	1.404	1.237		0.974	10.50	21.46	10.96
2	160656	1.276	1.911	2.326	0.941	1.561	1.236		0.975	10.47	21.40	10.93
3	160716	1.298	2.126	2.415	0.147	1.231	1.237		0.974	10.43	21.32	10.89
4	160732	1.217	2.114	2.342	1.640	0.981	1.237		0.975	10.42	21.31	10.89
5	160748	1.170	2.149	2.098	-1.022	0.784	1.237		0.975	10.39	21.25	10.86
6	160805	1.397	1.999	1.945	1.975	0.998	1.237		0.974	10.37	21.21	10.84
7	160821	1.537	2.096	1.980	-0.002	1.122	1.236		0.975	10.34	21.16	10.82
8	160836	1.676	2.129	2.030	3.513	0.890	1.237		0.974	10.32	21.12	10.80
9	160853	1.865	2.228	1.924	2.323	1.128	1.237		0.975	10.32	21.13	10.81
10	160915	1.490	1.915	1.887	1.201	1.392	1.238		0.977	10.27	21.07	10.80
11	160931	1.281	1.783	2.002	1.883	1.609	1.238		0.975	10.27	21.07	10.80
12	160947	0.963	1.494	1.766	2.412	1.179	1.237		0.977	10.25	21.04	10.79
13	161002	1.007	1.577	2.186	2.202	1.384	1.237		0.975	10.22	20.98	10.76
14	161020	1.026	2.191	2.659	1.032	1.420	1.238		0.975	10.22	20.99	10.77
15	161037	1.146	2.348	2.914	2.164	1.527	1.237		0.975	10.21	20.96	10.75
16	161056	1.841	2.733	2.935	2.263	1.560	1.239		0.974	10.19	20.93	10.74
17	161114	1.749	2.671	2.881	0.801	1.409	1.238		0.975	10.18	20.92	10.74
18	161134	1.489	2.007	2.176	-0.729	1.549	1.237		0.977	10.18	20.92	10.74
19	161205	0.502	0.713	0.486	3.777	0.361	1.237		0.975	10.22	20.89	10.67
20	161222	0.226	0.507	0.721	4.459	0.170	1.238		0.977	10.18	20.81	10.63
21	161243	-0.202	0.172	0.504	3.602	0.194	1.237		0.974	10.18	20.80	10.62
22	161300	-0.419	-0.083	0.100	0.128	-0.007	1.237		0.977	10.15	20.75	10.60
23	161321	-0.586	-0.738	-0.514	-0.395	-0.186	1.237		0.976	10.13	20.72	10.59
24	161339	-0.396	-0.897	-0.956	4.679	-0.553	1.237		0.977	10.13	20.72	10.59
25	161357	-0.806	-1.180	-1.104	2.317	-0.479	1.239		0.974	10.10	20.66	10.56
26	161413	-0.773	-1.136	-1.004	1.066	-0.318	1.239		0.976	10.09	20.65	10.56
27	161429	-0.668	-0.871	-0.750	1.728	-0.164	1.239		0.974	10.08	20.64	10.56
28	161447	-0.359	-0.384	-0.528	2.909	-0.284	1.239		0.977	10.05	20.65	10.60
29	161504	-0.627	-0.737	-0.820	-0.856	-0.413	1.238		0.975	10.03	20.62	10.59
30	161522	-0.384	-0.538	-0.550	0.300	-0.466	1.238		0.975	10.05	20.65	10.60
31	161540	-0.212	-0.452	-0.366	0.303	-0.377	1.239		0.976	10.04	20.64	10.60
32	161601	-0.403	-0.598	-0.456	2.552	-0.332	1.239		0.975	10.03	20.59	10.56
33	161618	-0.687	-0.596	-0.332	3.787	-0.404	1.239		0.976	10.03	20.60	10.57
34	161638	-0.454	-0.297	-0.179	1.780	-0.413	1.239		0.977	9.99	20.52	10.53
35	161700	-0.154	-0.153	-0.150	0.021	-0.234	1.240		0.979	10.01	20.56	10.55
36	161718	-0.149	0.150	-0.033	2.189	-0.037	1.239		0.977	10.00	20.55	10.55
	162758	0.000	0.000	0.000	0.000	0.000	1.422		1.134	12.19	24.97	12.78
	162819	0.001	0.000	0.001	-0.010	0.001	1.647		1.463	14.88	30.47	15.59
	162836	0.008	0.001	-0.005	-0.006	0.001	1.879		1.587	17.41	35.63	18.22

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	162946	1.194	1.348	1.762	1.564	1.622	2.098		1.867	19.61	40.07	20.46
2	163002	1.492	2.054	2.286	1.768	1.383	2.099		1.870	19.50	39.87	20.37
3	163018	1.232	2.208	2.365	1.758	1.047	2.099		1.868	19.48	39.82	20.34
4	163032	1.455	2.202	2.345	1.511	0.994	2.100		1.867	19.44	39.74	20.30
5	163046	1.258	2.199	2.100	1.415	0.970	2.098		1.866	19.37	39.61	20.24
6	163101	1.521	2.104	2.039	1.358	1.285	2.100		1.869	19.34	39.54	20.20
7	163114	1.740	2.113	2.216	1.543	1.224	2.100		1.871	19.32	39.51	20.19
8	163127	1.962	2.296	2.287	1.570	1.255	2.100		1.873	19.30	39.48	20.18
9	163142	1.992	2.266	1.982	1.493	1.378	2.100		1.872	19.24	39.36	20.12
10	163157	1.559	1.785	1.901	1.550	1.321	2.100		1.872	19.21	39.34	20.13
11	163211	1.298	1.697	1.971	1.782	1.516	2.101		1.871	19.18	39.28	20.10
12	163224	0.805	1.230	1.735	1.714	0.920	2.101		1.873	19.19	39.31	20.12
13	163237	0.975	1.388	2.335	2.232	1.275	2.100		1.871	19.14	39.22	20.08
14	163249	1.014	2.029	3.135	2.644	1.366	2.101		1.871	19.12	39.18	20.06
15	163303	1.303	2.640	3.485	2.964	1.473	2.100		1.872	19.12	39.19	20.07
16	163316	2.017	3.114	3.469	2.969	1.582	2.100		1.872	19.11	39.17	20.06
17	163330	2.119	2.956	3.282	2.733	1.571	2.101		1.875	19.09	39.12	20.03
18	163347	1.731	2.194	2.391	1.941	1.407	2.100		1.877	19.05	39.05	20.00
19	163410	0.575	0.995	0.764	0.594	0.229	2.102		1.874	19.09	39.01	19.92
20	163426	0.442	0.808	1.139	0.527	0.457	2.100		1.877	19.06	38.96	19.90
21	163441	0.014	0.682	1.329	0.811	0.531	2.102		1.878	19.03	38.91	19.88
22	163454	-0.284	0.219	0.824	0.808	0.226	2.102		1.876	19.03	38.91	19.88
23	163510	-0.456	-0.514	0.121	0.383	0.302	2.102		1.879	19.00	38.87	19.87
24	163525	-0.466	-0.923	-0.651	-0.216	-0.443	2.100		1.878	19.00	38.85	19.85
25	163542	-0.902	-1.285	-0.669	-0.603	-0.467	2.102		1.878	18.98	38.83	19.85
26	163557	-0.800	-1.157	-0.921	-0.689	-0.382	2.101		1.880	18.99	38.84	19.85
27	163611	-0.645	-0.836	-0.687	-0.600	-0.314	2.102		1.878	18.96	38.77	19.81
28	163627	-0.338	-0.350	-0.487	-0.378	-0.413	2.101		1.880	18.93	38.77	19.84
29	163641	-0.706	-0.786	-0.751	-0.588	-0.600	2.102		1.879	18.91	38.73	19.82
30	163655	-0.408	-0.774	-0.654	-0.416	-0.242	2.100		1.877	18.91	38.73	19.82
31	163707	-0.030	-0.635	-0.474	-0.354	-0.392	2.101		1.880	18.93	38.77	19.84
32	163722	-0.472	-0.824	-0.546	-0.377	-0.310	2.102		1.878	18.90	38.72	19.82
33	163735	-0.730	-0.754	-0.326	-0.169	-0.357	2.102		1.879	18.88	38.68	19.80
34	163748	-0.465	-0.350	-0.068	-0.044	-0.376	2.102		1.880	18.88	38.68	19.80
35	163805	-0.131	-0.144	0.026	0.001	-0.412	2.102		1.879	18.84	38.62	19.78
36	163822	-0.042	0.121	0.066	0.072	-0.105	2.100		1.880	18.87	38.68	19.81
	164029	0.000	0.000	0.000	0.000	0.000	2.367		2.131	22.67	46.38	23.71
	164044	-0.003	0.008	0.003	-0.007	-0.002	2.571		2.335	24.98	51.05	26.07
	164123	-0.009	0.002	-0.001	-0.015	-0.011	2.754		2.453	27.23	55.62	28.39

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	164219	1.070	1.306	1.607	1.460	1.548	2.968		2.647	29.23	59.60	30.37
2	164232	1.484	1.917	2.014	1.550	1.386	2.969		2.647	29.12	59.39	30.27
3	164245	1.471	2.057	1.982	1.261	1.011	2.969		2.647	29.07	59.30	30.23
4	164258	1.524	2.429	2.212	1.217	0.520	2.969		2.647	29.00	59.15	30.15
5	164311	1.404	2.627	2.261	1.377	0.479	2.971		2.649	28.93	59.01	30.08
6	164322	1.668	2.579	2.449	1.503	0.789	2.971		2.651	28.89	58.93	30.04
7	164339	1.812	2.707	2.841	1.945	1.390	2.972		2.650	28.80	58.76	29.96
8	164353	1.797	2.545	2.756	2.028	1.115	2.971		2.649	28.79	58.74	29.95
9	164410	1.948	2.496	2.268	1.823	1.385	2.971		2.651	28.72	58.59	29.87
10	164427	1.441	1.569	1.649	1.635	1.132	2.971		2.652	28.66	58.52	29.86
11	164442	1.061	1.177	1.521	1.796	1.708	2.972		2.652	28.63	58.46	29.83
12	164457	0.409	0.524	1.382	1.981	1.301	2.971		2.657	28.59	58.39	29.80
13	164512	0.398	0.823	2.461	2.341	1.835	2.972		2.667	28.56	58.33	29.77
14	164527	0.543	2.024	2.544	2.720	1.972	2.972		2.670	28.54	58.29	29.75
15	164602	1.278	3.425	4.752	4.214	2.027	2.973		2.679	28.47	58.14	29.67
16	164618	2.438	4.270	4.753	4.197	1.987	2.972		2.680	28.47	58.15	29.68
17	164630	2.483	3.731	4.083	3.272	1.786	2.971		2.681	28.43	58.08	29.65
18	164644	1.906	2.623	2.810	2.219	1.672	2.972		2.685	28.44	58.10	29.66
19	164715	0.641	1.178	1.060	0.652	0.496	2.971		2.692	28.40	57.91	29.51
20	164731	0.726	1.776	2.162	1.300	0.291	2.970		2.696	28.39	57.91	29.52
21	164748	0.357	1.800	2.762	1.980	0.931	2.973		2.695	28.36	57.83	29.47
22	164806	-0.224	1.110	2.425	2.154	0.752	2.972		2.698	28.33	57.78	29.45
23	164820	-0.671	-0.271	1.263	1.722	0.553	2.972		2.699	28.31	57.75	29.44
24	164836	-0.939	-0.987	-0.049	0.873	0.308	2.972		2.700	28.30	57.73	29.43
25	164854	-1.209	-1.715	-1.037	-0.038	0.244	2.972		2.703	28.27	57.67	29.40
26	164910	-1.070	-1.503	-1.081	-0.419	-0.028	2.972		2.705	28.25	57.63	29.38
27	164924	-0.815	-0.990	-0.745	-0.558	-0.010	2.970		2.702	28.25	57.62	29.37
28	164940	-0.562	-0.396	-0.596	-0.388	-0.489	2.972		2.707	28.23	57.63	29.40
29	164957	-0.799	-0.932	-1.003	-0.694	-0.540	2.971		2.706	28.19	57.56	29.37
30	165010	-0.588	-0.970	-0.942	-0.466	-0.522	2.971		2.710	28.16	57.50	29.34
31	165024	-0.385	-0.973	-0.785	-0.426	-0.423	2.971		2.713	28.15	57.49	29.34
32	165040	-0.733	-1.134	-0.773	-0.324	-0.242	2.973		2.713	28.14	57.48	29.34
33	165057	-1.021	-1.063	-0.449	-0.026	-0.257	2.971		2.713	28.14	57.48	29.34
34	165111	-0.259	-0.309	-0.049	0.129	-0.330	2.971		2.714	28.13	57.41	29.28
35	165123	-0.385	-0.159	0.131	0.160	-0.438	2.972		2.716	28.13	57.46	29.33
36	165138	-0.203	0.156	0.043	0.036	-0.095	2.972		2.717	28.11	57.41	29.30
	165246	0.000	0.000	0.000	0.000	0.000	3.221		3.048	31.69	64.65	32.96

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	165424	1.541	2.131	1.750	1.144	1.194	3.489		3.298	34.12	69.57	35.45
2	165437	2.819	4.003	2.948	1.177	0.776	3.488		3.298	34.04	69.42	35.38
3	165446	3.292	5.473	4.311	1.794	0.495	3.486		3.297	34.01	69.36	35.35
4	165459	3.086	6.133	5.089	2.570	0.764	3.489		3.298	33.96	69.27	35.31
5	165512	2.325	5.660	6.193	4.180	1.552	3.489		3.301	33.92	69.19	35.27
6	165527	1.931	4.367	6.037	5.092	2.431	3.489		3.297	33.88	69.11	35.23
7	165541	1.601	2.976	5.006	4.699	2.779	3.489		3.298	33.83	69.01	35.18
8	165555	1.543	2.182	3.524	3.586	2.300	3.489		3.300	33.82	68.99	35.17
9	165610	1.780	2.278	2.343	2.197	1.653	3.488		3.298	33.76	68.88	35.12
10	165628	1.394	1.451	1.447	1.605	1.136	3.489		3.300	33.70	68.79	35.09
11	165642	0.782	0.413	0.926	1.586	1.823	3.489		3.297	33.67	68.72	35.05
12	165657	0.124	-0.280	0.948	2.226	1.990	3.489		3.298	33.64	68.67	35.03
13	165713	0.207	0.302	2.872	3.998	3.097	3.489		3.298	33.61	68.62	35.01
14	165726	0.284	2.259	5.032	5.074	2.607	3.491		3.298	33.59	68.58	34.99
15	165740	1.248	4.154	6.141	5.314	2.409	3.490		3.298	33.58	68.55	34.97
16	165756	2.835	5.416	5.988	4.861	2.134	3.491		3.298	33.54	68.49	34.95
17	165815	2.886	4.628	4.794	3.388	1.772	3.491		3.298	33.51	68.44	34.93
18	165830	2.091	2.927	2.949	2.027	1.437	3.491		3.298	33.49	68.41	34.92
19	165902	0.784	1.552	1.346	0.679	0.161	3.492		3.302	33.53	68.34	34.81
20	165915	1.116	2.803	3.060	1.575	0.274	3.492		3.300	33.46	68.23	34.77
21	165929	0.741	3.080	4.310	2.832	0.909	3.491		3.300	33.44	68.19	34.75
22	165945	-0.038	2.010	4.115	3.624	1.370	3.491		3.302	33.45	68.21	34.76
23	165957	-0.903	0.042	2.607	3.245	1.281	3.492		3.302	33.44	68.19	34.75
24	170018	-1.319	-1.168	0.322	2.009	1.452	3.492		3.303	33.41	68.14	34.73
25	170033	-1.650	-2.331	-0.583	0.524	0.679	3.492		3.302	33.39	68.10	34.71
26	170047	-1.430	-2.019	-1.270	-0.116	-0.085	3.491		3.301	33.37	68.06	34.69
27	170101	-0.983	-1.191	-0.814	-0.588	-0.234	3.491		3.300	33.34	68.00	34.66
28	170115	-0.498	-0.474	-0.670	-0.534	-0.486	3.491		3.302	33.30	67.95	34.65
29	170129	-0.850	-1.161	-1.287	-0.931	-0.703	3.491		3.304	33.27	67.91	34.64
30	170143	-0.654	-1.370	-1.445	-0.849	-0.619	3.491		3.303	33.27	67.90	34.63
31	170157	-0.577	-1.550	-1.344	-0.772	-0.462	3.491		3.303	33.25	67.87	34.62
32	170211	-0.954	-1.773	-1.302	-0.571	-0.231	3.491		3.303	33.23	67.84	34.61
33	170223	-1.207	-1.500	-0.639	0.042	-0.201	3.491		3.304	33.22	67.82	34.60
34	170237	-0.910	-0.772	-0.010	0.297	-0.220	3.492		3.303	33.21	67.79	34.58
35	170251	-0.414	-0.208	0.301	0.354	-0.332	3.491		3.304	33.18	67.74	34.56
36	170305	-0.219	0.104	0.111	0.055	-0.205	3.491		3.304	33.18	67.75	34.57
	170455	0.000	0.000	0.000	0.000	0.000	3.777		3.547	36.80	75.11	38.31

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	170547	1.833	2.311	1.619	0.859	1.117	4.008		3.771	38.90	79.34	40.44
2	170559	3.798	5.262	3.211	0.670	0.530	4.008		3.774	38.81	79.17	40.36
3	170617	4.551	7.500	5.832	1.720	0.359	4.009		3.773	38.71	78.98	40.27
4	170634	4.088	8.221	8.253	4.207	0.959	4.007		3.773	38.63	78.82	40.19
5	170650	2.721	7.247	8.924	6.508	2.140	4.009		3.774	38.58	78.71	40.13
6	170712	1.721	4.945	7.825	7.305	3.398	4.008		3.774	38.48	78.52	40.04
7	170730	1.154	2.859	5.974	6.873	3.670	4.007		3.773	38.42	78.40	39.98
8	170746	1.198	1.578	3.644	4.730	3.487	4.008		3.774	38.36	78.28	39.92
9	170804	1.846	2.026	2.291	2.682	2.501	4.009		3.773	38.33	78.22	39.89
10	170825	1.594	1.051	1.124	1.826	1.570	4.008		3.775	38.27	78.12	39.85
11	170851	0.738	-0.199	0.527	1.967	2.422	4.010		3.774	38.21	78.01	39.80
12	170907	-0.345	-1.016	1.010	3.205	2.647	4.009		3.776	38.18	77.95	39.77
13	170924	-0.540	0.064	3.571	5.313	3.588	4.009		3.774	38.14	77.87	39.73
14	170942	0.061	2.700	6.380	6.518	3.385	4.010		3.777	38.09	77.78	39.69
15	170958	1.763	5.230	7.657	6.411	2.727	4.010		3.777	38.08	77.75	39.67
16	171016	3.766	6.897	6.860	5.068	2.092	4.010		3.777	38.05	77.72	39.67
17	171031	3.647	5.577	5.230	3.366	1.526	4.010		3.778	38.03	77.67	39.64
18	171048	2.469	3.428	3.138	1.984	1.450	4.010		3.775	38.03	77.65	39.62
19	171118	1.121	2.453	1.507	0.909	0.420	4.010		3.777	38.02	77.53	39.51
20	171131	1.925	3.953	3.921	1.866	0.282	4.010		3.777	38.01	77.52	39.51
21	171148	1.177	4.483	5.800	3.547	0.978	4.011		3.775	37.98	77.46	39.48
22	171206	0.040	3.013	5.743	4.943	1.743	4.010		3.777	37.97	77.44	39.47
23	171222	-1.009	0.306	3.787	4.821	2.168	4.010		3.778	37.91	77.32	39.41
24	171236	-1.869	-1.672	1.373	3.556	2.333	4.010		3.778	37.90	77.31	39.41
25	171251	-2.172	-2.962	-0.820	1.347	1.406	4.012		3.778	37.88	77.25	39.37
26	171304	-1.704	-2.719	-1.652	0.000	0.548	4.010		3.777	37.86	77.23	39.37
27	171318	-1.075	-1.468	-1.015	-0.572	-0.124	4.012		3.777	37.85	77.21	39.36
28	171336	-0.423	-0.434	-0.885	-0.808	-0.591	4.011		3.779	37.79	77.13	39.34
29	171349	-0.833	-1.358	-1.874	-1.613	-1.053	4.012		3.778	37.80	77.15	39.35
30	171402	-0.769	-2.028	-2.554	-1.781	-1.061	4.011		3.778	37.77	77.10	39.33
31	171416	-0.883	-2.622	-2.855	-1.724	-0.631	4.011		3.779	37.77	77.09	39.32
32	171436	-1.321	-2.959	-2.649	-1.218	-0.356	4.011		3.777	37.74	77.03	39.29
33	171455	-1.767	-2.683	-1.543	-0.143	-0.070	4.012		3.778	37.73	77.02	39.29
34	171508	-1.478	-1.555	-0.433	0.370	-0.088	4.012		3.781	37.70	76.97	39.27
35	171523	-0.813	-0.633	0.215	0.523	-0.272	4.010		3.778	37.71	76.98	39.27
36	171539	-0.335	0.030	0.185	0.208	-0.077	4.011		3.782	37.66	76.90	39.24
	171714	0.000	0.000	0.000	0.000	0.000	4.362		4.157	41.94	85.62	43.68

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	171821	2.384	2.920	1.428	0.458	1.032	4.646		4.362	44.04	89.86	45.82
2	171835	4.956	6.480	3.258	0.023	0.208	4.643		4.360	43.93	89.64	45.71
3	171851	5.737	9.261	6.594	1.350	-0.218	4.646		4.363	43.83	89.45	45.62
4	171906	4.780	9.969	9.758	4.341	0.405	4.646		4.364	43.75	89.29	45.54
5	171924	2.676	8.262	10.719	7.621	2.147	4.646		4.363	43.64	89.06	45.42
6	171940	1.342	5.150	9.281	9.210	4.223	4.646		4.361	43.58	88.94	45.36
7	171956	0.915	2.287	6.576	8.476	4.996	4.646		4.364	43.52	88.82	45.30
8	172017	1.138	1.084	3.665	5.658	4.635	4.646		4.363	43.45	88.67	45.22
9	172032	1.785	1.649	2.141	2.848	2.844	4.645		4.365	43.39	88.56	45.17
10	172048	1.344	0.701	0.829	1.852	2.044	4.645		4.363	43.34	88.49	45.15
11	172102	0.463	-0.896	0.601	3.035	3.151	4.646		4.363	43.29	88.38	45.09
12	172118	-0.634	-1.082	2.166	5.102	4.070	4.646		4.363	43.24	88.28	45.04
13	172134	-0.619	0.519	5.465	7.500	4.738	4.645		4.363	43.20	88.21	45.01
14	172149	0.206	4.037	8.858	8.287	3.653	4.646		4.363	43.17	88.15	44.98
15	172202	2.438	7.385	9.693	7.197	2.557	4.646		4.363	43.13	88.07	44.94
16	172217	5.081	9.058	8.340	5.241	1.836	4.645		4.363	43.11	88.04	44.93
17	172233	4.880	7.023	5.543	2.818	1.136	4.645		4.363	43.09	87.99	44.90
18	172247	2.838	3.763	3.022	1.600	1.244	4.645		4.366	43.07	87.95	44.88
19	172315	1.521	2.624	1.684	0.519	-0.046	4.646		4.365	43.05	87.82	44.77
20	172329	2.515	5.353	4.666	1.796	-0.152	4.646		4.366	43.02	87.75	44.73
21	172347	1.963	6.065	7.227	4.005	0.915	4.646		4.366	42.98	87.67	44.69
22	172400	0.361	4.189	7.274	5.948	1.864	4.646		4.366	42.97	87.66	44.69
23	172414	-1.275	0.939	5.430	6.502	2.585	4.647		4.366	42.94	87.60	44.66
24	172431	-2.296	-2.173	2.044	4.875	3.063	4.645		4.366	42.92	87.55	44.63
25	172445	-2.672	-3.787	-0.639	2.419	2.351	4.646		4.366	42.89	87.49	44.60
26	172459	-1.982	-3.475	-2.006	0.466	1.083	4.645		4.366	42.87	87.46	44.59
27	172512	-1.090	-1.854	-1.416	-0.628	0.157	4.645		4.366	42.86	87.44	44.58
28	172528	-0.243	-0.354	-1.162	-1.367	-1.049	4.647		4.368	42.79	87.35	44.56
29	172543	-0.548	-1.398	-2.833	-2.846	-1.893	4.645		4.366	42.77	87.30	44.53
30	172559	-0.534	-2.559	-4.226	-3.608	-2.088	4.646		4.366	42.76	87.28	44.52
31	172613	-0.972	-4.030	-5.133	-3.819	-1.508	4.646		4.369	42.75	87.27	44.52
32	172628	-1.955	-5.099	-5.279	-2.954	-0.594	4.646		4.366	42.72	87.20	44.48
33	172645	-2.697	-4.934	-3.633	-0.969	-0.123	4.646		4.368	42.70	87.17	44.47
34	172703	-2.336	-3.382	-1.505	0.531	0.496	4.646		4.369	42.68	87.14	44.46
35	172722	-1.406	-1.640	-0.050	0.877	0.234	4.646		4.369	42.66	87.09	44.43
36	172737	-0.431	-0.248	0.174	0.381	0.223	4.646		4.370	42.64	87.05	44.41
	172857	0.000	0.000	0.000	0.000	0.000	5.010		4.704	46.66	95.25	48.59

Beam B-1 - November 18, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
1	172953	2.806	3.107	1.118	0.028	1.152	5.291		4.998	48.41	98.83	50.42
2	173007	6.040	7.595	3.051	-0.699	0.073	5.290		4.994	48.29	98.59	50.30
3	173021	6.531	10.965	7.351	0.875	-0.395	5.292		4.995	48.17	98.36	50.19
4	173038	5.234	11.476	11.313	4.452	0.286	5.291		4.994	48.05	98.11	50.06
5	173054	2.529	8.877	12.522	8.472	2.313	5.292		4.996	47.96	97.93	49.97
6	173110	1.153	5.338	10.595	11.328	5.611	5.288		4.993	47.87	97.76	49.89
7	173125	0.612	1.660	6.741	9.972	6.617	5.291		4.998	47.81	97.63	49.82
8	173140	1.092	0.526	3.229	6.410	6.010	5.291		4.998	47.73	97.47	49.74
9	173158	1.895	1.464	1.806	3.008	3.764	5.291		4.996	47.66	97.33	49.67
10	173215	1.414	0.314	0.671	2.248	2.798	5.291		4.995	47.60	97.23	49.63
11	173230	0.142	-1.265	0.909	4.247	4.240	5.291		4.999	47.54	97.12	49.58
12	173245	-0.926	-1.150	3.236	6.893	5.350	5.292		4.996	47.50	97.03	49.53
13	173301	-0.709	1.292	7.066	9.337	5.414	5.291		4.998	47.44	96.91	49.47
14	173316	0.392	5.338	10.833	9.366	4.015	5.291		4.997	47.42	96.89	49.47
15	173334	3.123	9.425	11.266	7.409	2.176	5.291		4.997	47.37	96.79	49.42
16	173357	6.304	10.874	8.787	4.463	1.211	5.291		4.999	47.30	96.65	49.35
17	173413	6.177	8.075	5.219	1.895	0.870	5.292		4.999	47.26	96.57	49.31
18	173431	3.448	3.969	2.611	1.165	1.401	5.292		4.998	47.24	96.52	49.28
19	173509	2.210	3.248	1.546	0.298	0.299	5.290		4.996	47.20	96.32	49.12
20	173525	3.712	6.669	4.998	1.532	-0.165	5.292		4.999	47.15	96.24	49.09
21	173539	2.577	7.803	8.320	4.098	0.767	5.291		4.998	47.11	96.16	49.05
22	173552	0.439	5.251	8.903	6.604	2.081	5.292		4.999	47.10	96.13	49.03
23	173605	-1.619	1.124	6.607	7.988	3.474	5.292		5.003	47.04	96.02	48.98
24	173620	-2.877	-2.483	2.984	6.279	4.132	5.291		5.003	47.06	96.05	48.99
25	173640	-3.333	-4.499	-0.171	3.412	3.441	5.292		5.002	47.02	95.97	48.95
26	173653	-2.489	-4.371	-2.450	0.760	1.608	5.291		5.002	46.97	95.89	48.92
27	173708	-1.097	-2.133	-1.688	-0.734	0.305	5.292		5.005	46.95	95.83	48.88
28	173725	-0.035	-0.065	-1.197	-1.845	-1.238	5.292		5.005	46.92	95.82	48.90
29	173745	-0.097	-1.088	-3.324	-4.002	-2.486	5.291		5.004	46.86	95.70	48.84
30	173801	-0.263	-2.663	-5.556	-5.432	-3.004	5.291		5.004	46.84	95.68	48.84
31	173816	-0.797	-4.681	-7.054	-5.830	-2.225	5.291		5.002	46.84	95.68	48.84
32	173833	-2.301	-6.776	-7.579	-4.636	-0.954	5.292		5.003	46.80	95.60	48.80
33	173848	-3.413	-7.118	-5.720	-2.021	0.209	5.290		5.003	46.76	95.51	48.75
34	173902	-3.495	-5.510	-2.797	-0.060	0.859	5.292		5.005	46.74	95.48	48.74
35	173924	-2.436	-2.984	-0.430	1.075	0.616	5.292		5.003	46.73	95.47	48.74
36	173940	-1.015	-0.626	0.211	0.435	0.147	5.291		5.006	46.70	95.41	48.71
	174145	-0.002	-0.001	-0.001	-0.000	-0.000	5.741		5.326	51.06	104.30	53.24

Beam B-1 - November 18, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	Shear A/F - B/E	Load Mid	Shear B/E - C/D
	174227	0.003	0.005	0.009	-0.001	0.011	6.044		5.809	53.27	108.85	55.58
1	174908	3.485	3.520	0.785	-0.038	1.029	6.073		5.816	50.79	103.90	53.11
2	174922	7.875	9.370	2.810	-1.045	-0.214	6.072		5.818	50.75	103.83	53.08
3	174935	7.421	13.901	8.328	0.777	-0.760	6.073		5.819	50.71	103.76	53.05
4	174949	5.468	13.650	13.506	5.008	-0.163	6.073		5.816	50.68	103.69	53.01
5	175006	2.317	9.969	14.964	9.919	2.136	6.071		5.819	50.63	103.60	52.97
6	175020	0.630	4.956	11.644	13.076	5.633	6.074		5.818	50.59	103.52	52.93
7	175035	0.283	1.326	7.123	12.534	7.845	6.075		5.818	50.55	103.45	52.90
8	175048	0.998	0.286	3.141	7.568	7.606	6.076		5.820	50.54	103.44	52.90
9	175102	1.899	1.545	1.843	3.365	4.602	6.077		5.821	50.48	103.32	52.84
10	175119	1.265	0.005	0.681	3.111	3.510	6.075		5.821	50.43	103.25	52.82
11	175134	-0.122	-1.740	1.473	5.881	5.404	6.075		5.821	50.39	103.18	52.79
12	175150	-1.307	-1.151	4.278	8.850	6.242	6.075		5.821	50.35	103.09	52.74
13	175205	-0.890	1.713	8.835	11.482	5.761	6.075		5.819	50.34	103.08	52.74
14	175220	0.324	6.649	12.797	10.317	3.572	6.077		5.821	50.28	102.97	52.69
15	175236	3.550	10.990	13.097	7.320	1.247	6.075		5.821	50.26	102.91	52.65
16	175252	7.449	12.765	9.121	3.586	0.228	6.075		5.823	50.23	102.87	52.64
17	175306	7.323	9.209	4.819	1.134	0.141	6.074		5.823	50.22	102.86	52.64
18	175319	4.137	4.230	2.319	0.968	1.063	6.074		5.822	50.17	102.77	52.60
19	175346	3.192	3.587	1.428	0.071	-0.243	6.076		5.821	50.19	102.69	52.50
20	175400	5.460	8.397	5.229	0.648	-0.697	6.076		5.823	50.16	102.64	52.48
21	175414	3.389	10.167	9.563	4.141	0.152	6.074		5.825	50.12	102.56	52.44
22	175429	0.823	7.768	11.568	8.140	2.603	6.077		5.826	50.07	102.47	52.40
23	175447	-2.007	1.792	8.454	9.632	3.646	6.076		5.828	50.04	102.42	52.38
24	175503	-3.724	-2.549	4.019	8.479	4.888	6.075		5.826	50.03	102.40	52.37
25	175518	-3.984	-5.111	0.463	5.202	4.610	6.075		5.827	49.97	102.29	52.32
26	175531	-2.907	-5.142	-2.581	1.372	2.822	6.076		5.827	49.94	102.23	52.29
27	175547	-1.377	-2.557	-1.993	-0.525	0.461	6.075		5.827	49.92	102.18	52.26
28	175604	0.090	0.297	-1.119	-2.160	-2.038	6.077		5.831	49.87	102.14	52.27
29	175617	0.243	-0.452	-3.507	-5.057	-3.881	6.076		5.830	49.83	102.05	52.22
30	175630	0.176	-2.096	-6.187	-7.054	-4.481	6.076		5.831	49.79	101.99	52.20
31	175644	-0.440	-4.836	-8.154	-6.883	-2.836	6.075		5.828	49.79	102.01	52.22
32	175657	-2.607	-8.209	-9.864	-6.279	-1.852	6.075		5.829	49.74	101.92	52.18
33	175712	-4.331	-9.355	-7.917	-2.987	-0.092	6.075		5.830	49.72	101.88	52.16
34	175727	-4.966	-7.874	-4.145	0.007	0.939	6.076		5.833	49.70	101.84	52.14
35	175745	-3.918	-4.590	-0.815	1.362	0.755	6.076		5.831	49.65	101.74	52.09
36	175802	-1.789	-1.088	0.264	0.741	0.180	6.075		5.833	49.64	101.72	52.08
	175903	0.012	-0.024	0.054	0.023	0.070	6.950		5.889	41.06	84.53	43.47
	180500	0.013	-0.028	0.059	0.035	0.028	1.786		1.118	0.77	1.55	0.78

Beam B-2 - November 19, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	Shear A/F - B/E	Load Mid	Shear B/E - C/D
	101049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.45	0.88	0.43
1	101105	0.469	0.596	0.540	0.200	0.128	-0.001	-0.001	0.002	0.52	0.95	0.43
2	101121	0.363	0.518	0.486	0.317	0.066	-0.002	-0.001	0.001	0.52	0.95	0.43
3	101135	0.152	0.358	0.346	0.118	0.113	-0.002	-0.001	0.002	0.52	0.97	0.45
4	101151	0.074	0.072	0.117	-0.073	-0.021	0.000	-0.001	0.001	0.53	0.97	0.44
5	101206	0.032	0.157	-0.040	-0.175	-0.101	-0.001	-0.001	0.001	0.52	0.97	0.45
6	101219	0.210	0.112	-0.055	-0.131	0.452	0.000	-0.001	-0.001	0.53	0.99	0.46
7	101232	0.146	0.275	0.160	-0.041	-0.081	-0.002	-0.001	0.001	0.50	0.95	0.45
8	101245	0.246	0.568	0.396	0.185	0.088	-0.002	-0.001	-0.001	0.51	0.97	0.46
9	101258	0.198	0.519	0.404	0.087	-0.104	-0.001	-0.001	-0.002	0.51	0.97	0.46
10	101315	0.338	1.062	0.745	0.471	0.418	0.000	-0.001	0.000	0.48	0.96	0.48
11	101329	0.310	0.619	0.529	0.281	0.011	-0.002	-0.002	-0.004	0.49	0.98	0.49
12	101342	0.170	0.407	0.221	0.161	-0.281	-0.001	-0.002	-0.007	0.48	0.97	0.49
13	101415	-0.057	-0.108	-0.136	-0.242	-0.196	-0.002	-0.002	-0.003	0.48	0.99	0.51
14	101427	-0.346	-0.484	-0.631	-0.443	-0.372	-0.001	-0.002	-0.005	0.49	1.00	0.51
15	101439	-0.379	-0.699	-0.845	-0.848	-0.634	-0.002	-0.002	-0.007	0.49	0.99	0.50
16	101451	-0.283	-0.703	-0.987	-0.982	-0.321	-0.001	-0.003	-0.007	0.48	0.98	0.50
17	101504	-0.207	-0.644	-0.861	-0.748	-0.733	-0.001	-0.003	-0.007	0.48	0.99	0.51
18	101522	-0.122	-0.375	-0.507	-0.636	-0.683	-0.001	-0.003	-0.013	0.49	1.00	0.51
19	101553	0.230	1.021	1.255	1.288	1.312	-0.005	-0.004	-0.011	0.54	1.00	0.46
20	101608	0.237	1.525	1.902	1.646	1.193	-0.007	-0.006	-0.011	0.54	1.01	0.47
21	101622	0.298	2.043	2.419	1.905	1.232	-0.009	-0.006	-0.012	0.53	0.99	0.46
22	101635	0.191	2.578	2.807	2.227	1.427	-0.008	-0.006	-0.012	0.54	1.02	0.48
23	101651	0.213	2.601	2.794	2.287	1.312	-0.008	-0.007	-0.011	0.53	1.00	0.47
24	101706	0.217	2.249	2.533	1.988	1.420	-0.008	-0.007	-0.012	0.52	0.99	0.47
25	101718	1.013	2.001	2.222	1.642	1.226	-0.009	-0.007	-0.009	0.53	1.01	0.48
26	101734	0.941	1.661	1.848	1.431	1.022	-0.008	-0.007	-0.012	0.51	0.97	0.46
27	101747	0.872	1.424	1.421	1.061	0.761	-0.008	-0.007	-0.013	0.52	1.00	0.48
28	101803	1.012	1.295	1.354	1.057	0.684	-0.008	-0.007	-0.010	0.50	1.01	0.51
29	101816	1.348	2.176	2.340	1.850	1.180	-0.008	-0.007	-0.010	0.50	1.01	0.51
30	101830	1.457	2.379	2.612	2.152	1.472	-0.008	-0.007	-0.010	0.50	1.02	0.52
31	101844	1.351	2.314	2.771	2.292	1.390	-0.009	-0.007	-0.011	0.49	1.00	0.51
32	101858	1.386	2.301	2.664	2.187	1.145	-0.009	-0.007	-0.011	0.50	1.02	0.52
33	101913	1.145	2.021	2.234	1.755	0.876	-0.008	-0.007	-0.012	0.49	1.01	0.52
34	101925	0.900	1.375	1.569	1.138	0.506	-0.008	-0.007	-0.012	0.50	1.03	0.53
35	101941	0.486	1.166	0.674	0.406	0.047	-0.008	-0.007	-0.013	0.49	1.01	0.52
36	101959	0.036	0.094	0.122	0.137	0.169	-0.009	-0.007	-0.011	0.51	1.04	0.53
	102109	0.000	0.000	0.000	0.000	0.000	0.090	0.194	0.141	2.85	5.70	2.85
	102132	0.000	-0.002	-0.007	0.006	0.001	0.281	0.424	0.311	4.97	9.92	4.95
	102202	-0.005	-0.008	-0.009	0.004	0.001	0.596	0.721	0.607	7.60	15.21	7.61

Beam B-2 - November 19, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN) Shear	Forces (kN) Load	Forces (kN) Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	102234	-0.008	-0.011	-0.000	0.003	0.004	0.847	1.009	0.873	10.37	20.75	10.38
1	102257	0.252	0.626	0.791	0.355	-0.018	0.846	1.009	0.874	10.31	20.58	10.27
2	102310	0.227	0.392	0.269	0.378	-0.207	0.848	1.009	0.875	10.28	20.52	10.24
3	102323	-0.007	0.112	0.031	0.121	-0.117	0.847	1.009	0.876	10.21	20.39	10.18
4	102336	-0.051	-0.262	-0.256	-0.204	-0.045	0.848	1.009	0.875	10.21	20.38	10.17
5	102347	-0.107	-0.202	-0.417	-0.387	-0.196	0.846	1.009	0.876	10.21	20.38	10.17
6	102359	0.156	-0.051	-0.474	-0.303	-0.328	0.849	1.009	0.874	10.18	20.34	10.16
7	102413	0.115	0.181	-0.151	-0.221	-0.419	0.849	1.009	0.876	10.15	20.28	10.13
8	102426	0.163	0.474	0.281	-0.005	0.017	0.849	1.009	0.876	10.15	20.28	10.13
9	102441	0.388	0.557	0.360	0.124	-0.044	0.849	1.009	0.876	10.14	20.26	10.12
10	102457	1.049	1.141	0.701	0.553	0.238	0.850	1.009	0.875	10.12	20.27	10.15
11	102510	0.597	0.705	0.391	0.294	-0.174	0.849	1.009	0.874	10.11	20.26	10.15
12	102525	0.242	0.316	0.013	0.047	-0.247	0.849	1.009	0.876	10.10	20.24	10.14
13	102538	-0.076	-0.295	-0.464	-0.455	-0.095	0.848	1.010	0.874	10.08	20.21	10.13
14	102554	-0.466	-0.832	-1.005	-0.711	-0.150	0.850	1.009	0.876	10.05	20.14	10.09
15	102609	-0.453	-0.973	-1.268	-1.086	-0.392	0.851	1.009	0.876	10.06	20.16	10.10
16	102623	-0.396	-0.818	-1.227	-1.088	-0.259	0.850	1.010	0.875	10.03	20.13	10.10
17	102637	-0.199	-0.630	-0.958	-0.736	-0.614	0.850	1.010	0.875	10.06	20.17	10.11
18	102649	-0.042	-0.266	-0.503	-0.479	-0.306	0.850	1.010	0.875	10.04	20.13	10.09
19	102724	0.705	1.139	1.311	1.329	1.168	0.850	1.010	0.874	10.07	20.10	10.03
20	102752	1.224	1.924	2.254	1.955	1.752	0.850	1.010	0.877	10.07	20.09	10.02
21	102807	1.344	2.300	2.562	2.053	1.235	0.850	1.010	0.876	10.06	20.09	10.03
22	102823	1.707	2.931	3.155	2.539	1.560	0.851	1.010	0.876	10.03	20.02	9.99
23	102839	1.809	2.995	3.236	2.706	1.499	0.850	1.010	0.875	10.02	20.01	9.99
24	102853	1.712	2.561	2.905	2.433	1.925	0.849	1.010	0.874	10.00	19.99	9.99
25	102906	1.312	2.284	2.539	2.034	1.639	0.851	1.010	0.876	10.01	20.00	9.99
26	102922	0.978	1.754	2.030	1.690	1.147	0.852	1.010	0.877	10.00	19.99	9.99
27	102937	0.834	1.389	1.409	1.127	0.764	0.852	1.010	0.877	9.99	19.98	9.99
28	102951	1.130	1.392	1.477	1.216	0.801	0.852	1.010	0.877	9.96	19.96	10.00
29	103003	1.381	2.308	2.603	2.162	1.406	0.852	1.010	0.876	9.92	19.89	9.97
30	103017	1.613	2.587	2.776	2.636	1.610	0.852	1.010	0.876	9.95	19.95	10.00
31	103031	1.539	2.782	3.305	2.806	1.765	0.852	1.010	0.877	9.95	19.98	10.03
32	103045	1.562	2.901	3.227	2.592	1.361	0.852	1.010	0.877	9.94	19.94	10.00
33	103100	1.334	2.397	2.625	1.996	1.027	0.852	1.010	0.877	9.94	19.95	10.01
34	103114	1.027	1.695	1.809	1.278	0.512	0.852	1.010	0.876	9.92	19.91	9.99
35	103127	0.582	1.354	0.691	0.405	-0.007	0.853	1.010	0.875	9.91	19.89	9.98
36	103142	0.016	0.002	0.001	-0.021	-0.192	0.851	1.010	0.874	9.92	19.91	9.99
	103702	0.000	0.000	0.000	0.000	0.000	1.148	1.302	1.200	12.64	25.32	12.68
	103717	0.003	-0.000	0.004	-0.005	0.004	1.399	1.583	1.369	15.50	31.06	15.56
	103739	-0.003	0.002	-0.002	-0.002	-0.004	1.707	1.849	1.759	18.03	36.14	18.11

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	103807	0.001	0.011	-0.002	0.005	-0.009	1.867	2.091	1.835	20.06	40.20	20.14
1	103914	0.240	0.420	0.458	0.294	0.227	1.867	2.091	1.837	19.80	39.61	19.81
2	103928	0.070	-0.054	0.083	0.413	0.154	1.867	2.091	1.835	19.75	39.52	19.77
3	103942	-0.341	-0.585	-0.586	-0.081	-0.125	1.866	2.091	1.837	19.71	39.46	19.75
4	103956	-0.443	-1.190	-1.189	-0.744	-0.181	1.867	2.091	1.835	19.68	39.40	19.72
5	104009	-0.341	-1.057	-1.476	-1.171	-0.504	1.866	2.091	1.835	19.67	39.38	19.71
6	104022	0.094	-0.573	-1.405	-1.101	-0.723	1.866	2.091	1.835	19.64	39.33	19.69
7	104035	0.158	0.006	-0.687	-0.819	-0.755	1.864	2.091	1.834	19.62	39.29	19.67
8	104047	0.399	0.591	0.124	-0.253	-0.327	1.867	2.091	1.835	19.58	39.22	19.64
9	104101	0.511	0.619	0.292	0.110	0.245	1.867	2.091	1.837	19.58	39.22	19.64
10	104119	1.236	1.192	0.698	0.518	0.404	1.867	2.091	1.838	19.52	39.14	19.62
11	104133	0.657	0.679	0.262	0.088	-0.254	1.867	2.091	1.835	19.52	39.13	19.61
12	104147	0.300	0.200	-0.279	-0.338	-0.451	1.867	2.091	1.836	19.47	39.05	19.58
13	104201	-0.118	-0.588	-0.911	-0.889	-0.318	1.867	2.091	1.834	19.49	39.08	19.59
14	104215	-0.502	-1.021	-1.522	-1.093	-0.623	1.867	2.091	1.836	19.46	39.03	19.57
15	104229	-0.590	-1.408	-1.751	-1.496	-0.455	1.867	2.091	1.837	19.43	38.97	19.54
16	104243	-0.517	-1.087	-1.580	-1.243	-0.508	1.866	2.091	1.838	19.46	39.03	19.57
17	104301	-0.214	-0.788	-1.052	-0.749	-0.223	1.867	2.091	1.837	19.45	39.02	19.57
18	104315	-0.084	-0.300	-0.464	-0.419	-0.394	1.867	2.091	1.836	19.41	38.95	19.54
19	104347	0.803	1.271	1.369	1.322	0.963	1.867	2.091	1.834	19.44	38.89	19.45
20	104406	1.283	2.055	2.350	1.652	1.270	1.867	2.091	1.835	19.41	38.85	19.44
21	104422	1.724	2.869	2.982	2.204	0.941	1.867	2.091	1.837	19.40	38.83	19.43
22	104439	2.276	3.535	3.753	2.819	1.491	1.866	2.091	1.838	19.37	38.77	19.40
23	104455	2.120	3.655	3.986	3.267	1.812	1.867	2.091	1.835	19.35	38.74	19.39
24	104510	1.907	3.125	3.685	3.016	2.092	1.867	2.091	1.835	19.36	38.76	19.40
25	104529	1.426	2.493	3.164	2.564	2.087	1.867	2.091	1.839	19.34	38.72	19.38
26	104544	0.985	1.951	2.487	2.183	1.489	1.867	2.091	1.835	19.33	38.71	19.38
27	104602	0.751	1.448	1.591	1.283	0.915	1.867	2.091	1.835	19.31	38.67	19.36
28	104618	1.164	1.461	1.689	1.372	0.941	1.867	2.091	1.838	19.29	38.68	19.39
29	104636	1.381	2.458	2.999	2.549	1.625	1.867	2.091	1.839	19.27	38.65	19.38
30	104656	1.759	3.037	3.743	3.289	1.932	1.867	2.091	1.839	19.23	38.57	19.34
31	104715	1.818	3.446	3.797	3.297	2.097	1.867	2.091	1.836	19.28	38.72	19.44
32	104732	2.155	3.705	4.194	3.194	1.574	1.867	2.091	1.837	19.25	38.61	19.36
33	104749	1.712	3.198	3.392	2.338	1.065	1.867	2.091	1.836	19.22	38.58	19.36
34	104802	1.303	2.215	2.239	1.335	0.467	1.868	2.091	1.836	19.24	38.61	19.37
35	104820	0.757	1.224	0.889	0.273	-0.176	1.867	2.091	1.836	19.24	38.61	19.37
36	104835	0.097	0.055	0.036	-0.136	-0.314	1.867	2.091	1.835	19.20	38.54	19.34
	105123	-0.002	0.001	0.006	0.002	0.011	2.203	2.397	2.117	22.84	45.79	22.95
	105144	0.009	0.005	0.007	0.005	0.009	2.386	2.610	2.264	24.98	50.04	25.06
	105204	0.022	0.010	0.008	0.008	0.006	2.673	2.925	2.545	27.73	55.52	27.79

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	105226	0.033	-0.010	0.012	0.027	0.021	2.928	3.182	2.785	30.21	60.46	30.25
1	105259	0.087	0.147	0.522	0.610	0.366	2.928	3.190	2.793	29.82	59.61	29.79
2	105316	-0.486	-0.991	-0.359	0.834	0.492	2.928	3.190	2.791	29.69	59.38	29.69
3	105331	-1.279	-2.339	-1.975	-0.222	0.440	2.929	3.190	2.790	29.64	59.27	29.63
4	105343	-1.281	-3.263	-3.374	-1.625	-0.184	2.928	3.190	2.792	29.57	59.13	29.56
5	105358	-0.967	-2.776	-3.946	-2.634	-1.012	2.928	3.190	2.793	29.50	58.99	29.49
6	105421	-0.037	-1.569	-3.516	-2.772	-0.978	2.928	3.190	2.792	29.43	58.87	29.44
7	105438	0.369	-0.166	-1.972	-2.087	-1.251	2.928	3.190	2.793	29.36	58.72	29.36
8	105454	0.693	0.773	-0.371	-0.944	-0.696	2.928	3.190	2.792	29.30	58.61	29.31
9	105510	0.656	0.731	0.356	-0.214	-0.024	2.928	3.191	2.793	29.28	58.58	29.30
10	105526	1.312	1.242	0.651	0.271	0.263	2.928	3.191	2.791	29.21	58.48	29.27
11	105540	0.957	0.705	-0.190	-0.623	-0.456	2.928	3.191	2.793	29.17	58.40	29.23
12	105557	0.478	-0.178	-1.347	-1.455	-0.902	2.930	3.191	2.791	29.15	58.36	29.21
13	105613	-0.192	-1.563	-2.501	-2.266	-0.984	2.930	3.192	2.793	29.10	58.27	29.17
14	105628	-0.962	-2.664	-3.444	-2.412	-0.930	2.928	3.192	2.791	29.11	58.29	29.18
15	105644	-1.251	-3.016	-3.358	-2.322	-0.564	2.928	3.192	2.791	29.05	58.18	29.13
16	105700	-1.147	-2.499	-2.625	-1.489	-0.043	2.928	3.192	2.791	29.02	58.11	29.09
17	105716	-0.609	-1.561	-1.447	-0.526	0.071	2.928	3.192	2.793	29.00	58.07	29.07
18	105733	0.054	-0.436	-0.513	0.144	-0.201	2.929	3.192	2.791	28.98	58.04	29.06
19	105803	1.036	1.445	1.468	1.272	1.017	2.928	3.193	2.794	28.99	57.96	28.97
20	105820	1.799	2.725	2.728	1.659	1.041	2.927	3.193	2.790	28.97	57.92	28.95
21	105837	2.294	3.793	3.716	2.206	0.813	2.928	3.193	2.792	28.97	57.91	28.94
22	105854	2.977	4.786	4.925	3.397	1.619	2.928	3.193	2.791	28.93	57.86	28.93
23	105912	2.695	4.874	5.400	4.291	2.221	2.928	3.193	2.794	28.90	57.80	28.90
24	105928	2.174	4.219	5.289	4.423	2.713	2.928	3.193	2.793	28.89	57.77	28.88
25	105947	1.450	3.080	4.354	3.944	2.588	2.928	3.193	2.791	28.86	57.72	28.86
26	110002	0.819	1.923	2.979	2.930	2.037	2.928	3.193	2.790	28.83	57.66	28.83
27	110018	0.761	1.341	1.667	1.563	1.239	2.928	3.193	2.793	28.82	57.65	28.83
28	110037	1.165	1.354	1.791	1.611	1.266	2.928	3.193	2.793	28.78	57.61	28.83
29	110056	1.252	2.312	3.399	3.141	2.074	2.928	3.194	2.791	28.75	57.56	28.81
30	110112	1.821	3.453	4.774	4.395	2.606	2.928	3.194	2.792	28.74	57.54	28.80
31	110129	2.218	4.370	5.236	4.607	2.706	2.928	3.194	2.792	28.74	57.54	28.80
32	110146	2.764	4.964	5.602	4.070	1.954	2.928	3.194	2.792	28.70	57.48	28.78
33	110201	2.376	4.478	4.594	2.867	1.119	2.928	3.194	2.794	28.69	57.45	28.76
34	110217	2.007	3.246	3.027	1.459	0.401	2.928	3.194	2.795	28.70	57.48	28.78
35	110233	1.199	2.178	1.172	0.153	-0.462	2.929	3.194	2.794	28.67	57.43	28.76
36	110249	0.226	0.148	0.032	-0.262	-0.515	2.929	3.194	2.793	28.68	57.44	28.76
	110430	0.000	0.000	0.000	0.000	0.000	3.263	3.565	3.094	32.89	65.79	32.90

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	110449	0.003	0.004	0.002	-0.004	0.004	3.519	3.845	3.325	35.58	71.15	35.57
1	110550	-0.218	-0.117	0.570	0.851	0.399	3.708	4.070	3.517	36.56	73.00	36.44
2	110605	-1.296	-2.283	-0.875	0.956	0.437	3.709	4.070	3.520	36.48	72.85	36.37
3	110619	-2.340	-4.352	-3.415	-0.622	0.559	3.709	4.069	3.524	36.38	72.66	36.28
4	110635	-2.219	-5.469	-5.477	-2.775	-0.526	3.709	4.069	3.527	36.32	72.53	36.21
5	110648	-1.431	-4.573	-6.237	-4.416	-1.843	3.709	4.069	3.533	36.26	72.42	36.16
6	110702	0.038	-2.469	-5.353	-4.727	-1.808	3.708	4.069	3.537	36.19	72.28	36.09
7	110716	0.704	-0.361	-3.091	-3.873	-2.484	3.709	4.069	3.544	36.14	72.19	36.05
8	110729	0.841	0.984	-0.753	-2.106	-1.650	3.708	4.069	3.544	36.09	72.11	36.02
9	110747	0.754	0.969	0.328	-0.483	-0.349	3.709	4.069	3.548	36.07	72.05	35.98
10	110802	1.411	1.485	0.565	-0.132	-0.116	3.708	4.069	3.551	35.99	71.93	35.94
11	110817	1.162	0.863	-0.886	-1.767	-1.282	3.709	4.069	3.555	35.96	71.88	35.92
12	110830	0.635	-0.557	-2.901	-3.190	-2.003	3.709	4.069	3.558	35.91	71.78	35.87
13	110843	-0.343	-2.769	-4.696	-4.211	-2.055	3.708	4.069	3.559	35.91	71.78	35.87
14	110856	-1.655	-4.637	-5.839	-3.923	-1.486	3.709	4.069	3.561	35.87	71.71	35.84
15	110911	-2.354	-5.256	-5.352	-3.098	-0.566	3.709	4.069	3.562	35.84	71.66	35.82
16	110928	-2.299	-4.366	-3.792	-1.395	0.332	3.708	4.069	3.563	35.82	71.62	35.80
17	110942	-1.393	-2.607	-1.716	-0.051	0.490	3.709	4.069	3.565	35.79	71.56	35.77
18	110956	-0.464	-0.772	-0.325	0.099	-0.006	3.709	4.068	3.569	35.79	71.57	35.78
19	111030	1.175	1.612	1.259	1.160	1.019	3.707	4.068	3.571	35.80	71.45	35.65
20	111046	2.620	3.544	3.154	1.950	1.258	3.708	4.068	3.573	35.75	71.38	35.63
21	111105	2.852	4.941	4.256	2.011	0.559	3.709	4.068	3.575	35.73	71.34	35.61
22	111122	3.517	6.255	6.036	3.768	1.632	3.710	4.068	3.576	35.69	71.26	35.57
23	111139	3.309	6.428	7.028	5.312	2.668	3.709	4.068	3.579	35.67	71.24	35.57
24	111155	2.274	5.246	6.944	5.774	3.363	3.708	4.068	3.576	35.65	71.21	35.56
25	111210	1.062	3.313	5.489	5.329	3.345	3.707	4.068	3.578	35.62	71.14	35.52
26	111229	0.383	1.838	3.452	3.750	2.704	3.710	4.068	3.579	35.60	71.11	35.51
27	111242	0.450	1.212	1.720	1.774	1.386	3.708	4.068	3.576	35.61	71.12	35.51
28	111300	0.927	1.205	1.910	1.891	1.397	3.710	4.068	3.579	35.55	71.08	35.53
29	111316	0.987	2.298	3.861	3.925	2.632	3.709	4.068	3.577	35.55	71.06	35.51
30	111336	1.622	3.775	5.674	5.504	3.180	3.709	4.068	3.581	35.50	70.97	35.47
31	111354	2.313	5.268	6.899	5.741	3.161	3.709	4.068	3.579	35.50	70.97	35.47
32	111413	3.258	6.300	6.892	5.019	2.286	3.709	4.068	3.581	35.45	70.87	35.42
33	111427	3.051	5.918	5.727	3.369	1.125	3.709	4.068	3.583	35.44	70.87	35.43
34	111443	2.752	4.402	3.595	1.395	0.073	3.709	4.068	3.586	35.41	70.81	35.40
35	111500	1.917	2.978	1.280	-0.102	-0.739	3.709	4.068	3.586	35.41	70.80	35.39
36	111515	0.579	0.369	-0.063	-0.385	-0.531	3.709	4.068	3.590	35.40	70.78	35.38
	111633	0.000	0.000	0.000	0.000	0.000	3.878	4.221	3.672	37.84	75.60	37.76

Beam B-2 - November 19, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	111701	-0.003	-0.052	-0.040	0.028	-0.002	4.088	4.465	3.844	40.16	80.23	40.07
1	111742	-0.649	-0.299	0.585	1.015	0.884	4.087	4.466	3.848	39.84	79.52	39.68
2	111800	-1.793	-2.901	-1.061	1.040	1.041	4.087	4.466	3.844	39.76	79.37	39.61
3	111814	-2.884	-5.253	-3.971	-0.689	0.727	4.087	4.467	3.848	39.70	79.26	39.56
4	111831	-2.686	-6.417	-6.451	-3.249	-0.448	4.088	4.467	3.844	39.62	79.11	39.49
5	111847	-1.824	-5.352	-7.324	-5.207	-1.981	4.087	4.467	3.846	39.56	78.98	39.42
6	111901	-0.083	-2.860	-6.280	-5.730	-2.134	4.087	4.467	3.844	39.51	78.89	39.38
7	111920	0.802	-0.446	-3.769	-4.792	-3.139	4.087	4.467	3.848	39.47	78.80	39.33
8	111937	0.809	1.174	-0.981	-2.722	-2.099	4.087	4.467	3.844	39.43	78.74	39.31
9	111948	0.639	1.100	0.282	-0.758	-0.517	4.087	4.468	3.846	39.38	78.64	39.26
10	112003	1.338	1.625	0.487	-0.440	-0.287	4.087	4.468	3.846	39.36	78.64	39.28
11	112018	1.266	1.058	-1.263	-2.513	-1.700	4.087	4.468	3.846	39.31	78.54	39.23
12	112034	0.863	-0.700	-3.793	-4.228	-2.657	4.087	4.468	3.844	39.29	78.52	39.23
13	112049	-0.425	-3.369	-5.849	-5.282	-2.513	4.087	4.468	3.848	39.25	78.43	39.18
14	112106	-1.924	-5.460	-7.042	-4.748	-1.571	4.087	4.468	3.848	39.18	78.29	39.11
15	112119	-2.872	-6.414	-6.354	-3.476	-0.314	4.088	4.468	3.844	39.20	78.34	39.14
16	112134	-3.010	-5.464	-4.345	-1.248	0.728	4.087	4.468	3.844	39.17	78.28	39.11
17	112151	-1.951	-3.229	-1.836	0.277	0.816	4.088	4.468	3.845	39.12	78.19	39.07
18	112204	-0.690	-0.921	-0.218	0.252	0.075	4.088	4.468	3.847	39.10	78.14	39.04
19	112234	1.135	1.728	1.107	0.642	0.973	4.088	4.468	3.848	39.15	78.12	38.97
20	112251	2.554	3.764	2.366	0.747	0.563	4.087	4.468	3.849	39.09	78.01	38.92
21	112312	3.395	5.830	4.548	1.751	0.240	4.087	4.469	3.848	39.06	77.95	38.89
22	112328	4.055	7.402	6.735	3.907	1.497	4.088	4.469	3.847	39.03	77.90	38.87
23	112343	3.354	7.376	7.977	5.847	2.879	4.087	4.469	3.848	39.01	77.88	38.87
24	112359	2.544	5.980	7.770	6.974	3.872	4.087	4.469	3.850	38.96	77.79	38.83
25	112417	1.112	3.479	6.086	6.622	4.209	4.087	4.469	3.851	38.96	77.79	38.83
26	112433	0.209	1.779	3.646	4.658	3.448	4.089	4.469	3.848	38.94	77.75	38.81
27	112446	0.227	1.103	1.641	1.948	1.870	4.087	4.469	3.848	38.92	77.71	38.79
28	112501	1.227	1.965	3.027	3.571	3.854	4.088	4.469	3.847	38.88	77.70	38.82
29	112534	0.702	2.100	3.904	4.374	3.178	4.089	4.469	3.850	38.85	77.65	38.80
30	112551	1.384	3.794	6.035	6.180	3.822	4.088	4.469	3.851	38.81	77.57	38.76
31	112607	2.235	5.610	7.449	6.419	3.634	4.088	4.469	3.848	38.80	77.54	38.74
32	112622	3.310	6.985	7.576	5.432	2.452	4.088	4.469	3.850	38.79	77.53	38.74
33	112639	3.342	6.821	6.286	3.443	1.091	4.088	4.469	3.850	38.78	77.50	38.72
34	112653	3.118	5.081	3.762	1.262	-0.010	4.088	4.469	3.851	38.76	77.46	38.70
35	112710	2.109	2.792	1.072	-0.423	-0.841	4.087	4.469	3.851	38.72	77.39	38.67
36	112726	0.629	0.383	-0.273	-0.557	-0.417	4.087	4.469	3.848	38.73	77.41	38.68
	113115	0.000	0.000	0.000	0.000	0.000	4.378	4.816	4.298	42.83	85.54	42.71

Beam B-2 - November 19, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	113144	0.018	0.004	0.003	0.004	0.003	4.625	5.091	4.481	45.32	90.51	45.19
1	113250	-0.732	-0.542	0.681	1.319	0.774	4.625	5.097	4.485	44.73	89.26	44.53
2	113309	-2.598	-3.932	-1.280	1.558	1.187	4.626	5.098	4.483	44.61	89.03	44.42
3	113324	-3.820	-6.647	-4.683	-0.382	1.033	4.626	5.098	4.485	44.55	88.90	44.35
4	113341	-3.212	-7.798	-7.664	-3.415	-0.289	4.625	5.098	4.483	44.48	88.77	44.29
5	113356	-1.770	-6.218	-8.803	-5.801	-2.227	4.626	5.099	4.483	44.42	88.65	44.23
6	113410	0.387	-2.910	-7.263	-6.355	-2.598	4.626	5.099	4.484	44.37	88.54	44.17
7	113422	1.314	-0.178	-4.397	-5.527	-3.910	4.626	5.099	4.484	44.29	88.41	44.12
8	113435	1.326	1.572	-1.131	-3.014	-2.842	4.626	5.099	4.484	44.25	88.32	44.07
9	113451	1.042	1.445	0.394	-0.612	-0.810	4.625	5.099	4.487	44.20	88.23	44.03
10	113509	1.738	1.955	0.534	-0.364	-0.547	4.626	5.100	4.484	44.14	88.14	44.00
11	113522	1.863	1.433	-1.602	-2.914	-2.465	4.626	5.100	4.487	44.12	88.10	43.98
12	113539	1.407	-0.487	-4.607	-5.060	-3.437	4.626	5.100	4.488	44.06	87.99	43.93
13	113554	0.038	-3.709	-7.064	-6.247	-3.101	4.625	5.100	4.487	44.01	87.90	43.89
14	113611	-2.110	-6.589	-8.430	-5.281	-1.828	4.626	5.100	4.487	44.00	87.88	43.88
15	113624	-3.445	-7.798	-7.382	-3.368	-0.006	4.626	5.100	4.487	43.96	87.80	43.84
16	113640	-3.817	-6.674	-4.682	-0.500	1.352	4.626	5.100	4.485	43.94	87.76	43.82
17	113655	-2.681	-4.006	-1.594	1.178	1.354	4.626	5.100	4.486	43.91	87.70	43.79
18	113711	-1.016	-1.160	0.094	0.976	0.337	4.627	5.100	4.487	43.87	87.62	43.75
19	113738	1.721	1.971	0.999	0.723	0.849	4.626	5.100	4.486	43.88	87.53	43.65
20	113759	3.284	4.354	2.781	0.207	0.096	4.626	5.100	4.490	43.84	87.45	43.61
21	113815	4.352	7.028	5.063	1.382	-0.332	4.626	5.100	4.490	43.81	87.41	43.60
22	113832	4.892	8.779	7.830	4.176	1.208	4.627	5.099	4.491	43.77	87.33	43.56
23	113847	3.822	8.675	9.403	6.726	2.969	4.626	5.100	4.489	43.74	87.27	43.53
24	113902	2.390	6.557	9.087	8.215	4.279	4.626	5.099	4.492	43.70	87.20	43.50
25	113920	0.450	3.398	6.988	7.634	5.116	4.627	5.099	4.491	43.68	87.15	43.47
26	113940	0.004	1.378	3.938	5.553	4.145	4.626	5.099	4.490	43.65	87.11	43.46
27	113956	0.045	0.787	1.705	2.321	2.346	4.626	5.099	4.492	43.60	87.01	43.41
28	114017	0.855	0.850	1.969	2.327	1.899	4.627	5.099	4.494	43.54	86.95	43.41
29	114033	0.683	1.861	4.415	5.168	3.495	4.626	5.099	4.497	43.51	86.88	43.37
30	114049	1.234	3.781	6.856	7.179	4.116	4.626	5.098	4.497	43.49	86.85	43.36
31	114107	2.377	6.126	8.625	7.195	3.926	4.625	5.098	4.496	43.48	86.85	43.37
32	114125	3.977	7.982	8.715	6.202	2.636	4.627	5.098	4.498	43.44	86.76	43.32
33	114141	4.143	8.055	7.394	3.828	0.944	4.626	5.098	4.499	43.41	86.70	43.29
34	114155	4.116	6.386	4.459	1.241	-0.471	4.627	5.098	4.498	43.39	86.67	43.28
35	114210	2.967	3.573	1.322	-0.620	-1.209	4.626	5.098	4.500	43.38	86.65	43.27
36	114225	0.885	0.407	-0.299	-0.691	-0.668	4.627	5.098	4.501	43.37	86.63	43.26
	114359	0.000	0.000	0.000	0.000	0.000	4.958	5.495	4.835	47.90	95.61	47.71

Beam B-2 - November 19, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	114424	-0.021	0.004	-0.014	-0.018	0.001	5.206	5.751	5.000	50.11	100.00	49.89
1	114459	-1.279	-0.927	0.757	1.529	0.889	5.216	5.766	5.003	49.70	99.14	49.44
2	114515	-3.872	-5.184	-1.585	1.832	1.507	5.217	5.766	5.004	49.52	98.77	49.25
3	114530	-4.970	-8.208	-5.490	-0.339	1.366	5.215	5.767	5.003	49.40	98.53	49.13
4	114543	-4.012	-9.203	-8.917	-3.741	-0.084	5.214	5.767	5.002	49.29	98.31	49.02
5	114601	-2.069	-7.248	-10.294	-6.632	-2.331	5.216	5.768	5.006	49.19	98.11	48.92
6	114616	0.663	-3.042	-8.015	-7.593	-3.528	5.216	5.768	5.004	49.14	97.99	48.85
7	114630	1.314	0.035	-4.875	-6.493	-4.425	5.217	5.769	5.006	49.07	97.83	48.76
8	114643	1.148	1.672	-1.509	-4.243	-3.718	5.217	5.768	5.006	48.95	97.63	48.68
9	114657	0.768	1.438	0.280	-1.203	-1.196	5.215	5.768	5.006	48.91	97.56	48.65
10	114714	1.478	2.009	0.551	-0.925	-0.938	5.214	5.768	5.009	48.81	97.39	48.58
11	114728	2.075	1.671	-1.897	-3.914	-3.462	5.216	5.768	5.008	48.77	97.32	48.55
12	114745	1.442	-0.730	-5.612	-6.683	-4.324	5.216	5.768	5.010	48.70	97.18	48.48
13	114801	0.089	-4.174	-8.433	-7.469	-3.691	5.216	5.767	5.012	48.63	97.05	48.42
14	114815	-2.369	-7.674	-10.054	-6.329	-2.096	5.215	5.767	5.013	48.59	96.96	48.37
15	114830	-4.282	-9.398	-8.774	-3.729	0.284	5.216	5.767	5.014	48.53	96.84	48.31
16	114847	-5.146	-8.346	-5.427	-0.301	1.893	5.216	5.767	5.015	48.47	96.73	48.26
17	114903	-4.012	-5.075	-1.665	1.661	1.775	5.215	5.767	5.017	48.43	96.65	48.22
18	114919	-1.797	-1.555	0.289	1.272	0.579	5.217	5.767	5.017	48.39	96.58	48.19
19	114947	1.746	2.087	0.720	0.116	0.832	5.215	5.766	5.022	48.41	96.49	48.08
20	115003	4.040	5.080	2.600	-0.358	-0.177	5.215	5.766	5.020	48.34	96.35	48.01
21	115017	5.079	8.198	5.316	0.978	-0.913	5.216	5.766	5.021	48.30	96.28	47.98
22	115034	5.359	10.161	8.727	4.364	0.865	5.215	5.766	5.021	48.27	96.24	47.97
23	115049	3.859	9.765	10.562	7.341	3.020	5.216	5.766	5.021	48.22	96.13	47.91
24	115104	1.935	7.216	10.290	8.979	5.126	5.217	5.766	5.024	48.20	96.10	47.90
25	115120	0.131	3.152	7.451	8.990	5.563	5.217	5.766	5.024	48.17	96.04	47.87
26	115135	-0.689	0.744	4.045	6.272	4.875	5.215	5.766	5.024	48.16	96.03	47.87
27	115149	-0.199	0.492	1.487	2.506	2.598	5.215	5.766	5.022	48.12	95.95	47.83
28	115211	0.850	0.611	1.871	2.906	2.317	5.216	5.766	5.024	48.08	95.93	47.85
29	115227	0.370	1.435	4.367	6.056	4.403	5.217	5.766	5.024	48.04	95.84	47.80
30	115243	0.899	3.672	7.345	8.602	5.050	5.217	5.766	5.024	48.03	95.83	47.80
31	115259	2.103	6.672	9.724	8.567	4.775	5.216	5.766	5.024	47.99	95.76	47.77
32	115318	3.939	9.016	10.097	6.953	2.777	5.216	5.766	5.024	47.97	95.73	47.76
33	115339	4.702	9.436	8.234	4.056	0.705	5.215	5.766	5.024	47.94	95.65	47.71
34	115359	5.041	7.757	5.008	1.081	-0.672	5.216	5.764	5.026	47.89	95.56	47.67
35	115415	3.786	4.186	1.192	-1.071	-1.456	5.215	5.762	5.026	47.88	95.55	47.67
36	115431	1.422	0.669	-0.605	-0.983	-0.657	5.216	5.762	5.026	47.87	95.52	47.65
	115706	0.000	0.000	0.000	0.000	0.000	5.598	6.217	5.461	52.79	105.26	52.47

Beam B-2 - November 19, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	115731	-0.002	-0.004	0.004	-0.004	0.008	5.821	6.526	5.623	55.30	110.21	54.91
1	115829	-2.056	-1.241	1.221	1.671	0.904	5.821	6.530	5.626	54.29	108.11	53.82
2	115842	-5.053	-6.426	-1.660	2.026	1.630	5.822	6.531	5.628	54.18	107.90	53.72
3	115856	-5.545	-9.662	-6.005	-0.139	1.669	5.822	6.531	5.627	54.09	107.70	53.61
4	115914	-4.070	-9.803	-9.852	-3.946	0.191	5.821	6.532	5.626	54.01	107.53	53.52
5	115927	-2.337	-8.231	-11.995	-7.814	-2.530	5.821	6.533	5.626	53.86	107.26	53.40
6	115941	0.503	-3.934	-10.073	-9.511	-4.273	5.821	6.533	5.628	53.76	107.05	53.29
7	115957	1.690	-0.053	-6.128	-8.471	-5.713	5.822	6.533	5.629	53.69	106.89	53.20
8	120012	1.509	1.998	-1.650	-5.234	-4.856	5.821	6.533	5.629	53.60	106.74	53.14
9	120029	1.379	1.807	0.402	-1.381	-1.762	5.822	6.533	5.630	53.52	106.57	53.05
10	120050	1.810	2.355	0.660	-1.356	-1.539	5.822	6.533	5.632	53.44	106.43	52.99
11	120104	2.292	2.094	-2.131	-5.133	-4.455	5.823	6.532	5.633	53.35	106.27	52.92
12	120117	2.038	-0.342	-6.307	-8.005	-5.512	5.823	6.532	5.636	53.33	106.22	52.89
13	120132	0.276	-4.776	-9.874	-9.232	-4.598	5.822	6.532	5.638	53.28	106.13	52.85
14	120151	-2.524	-8.901	-11.745	-7.530	-2.261	5.821	6.532	5.638	53.20	105.98	52.78
15	120204	-4.167	-9.792	-9.550	-3.884	0.710	5.821	6.532	5.641	53.19	105.97	52.78
16	120220	-5.561	-9.661	-5.706	0.170	2.383	5.822	6.531	5.646	53.10	105.80	52.70
17	120234	-5.220	-6.107	-1.502	2.062	2.030	5.822	6.531	5.653	53.03	105.65	52.62
18	120252	-2.557	-1.796	0.756	1.416	0.609	5.820	6.531	5.655	52.98	105.55	52.57
19	120317	2.519	2.323	0.357	-0.057	0.756	5.822	6.531	5.657	52.98	105.41	52.43
20	120330	5.171	5.913	2.479	-0.988	-0.453	5.822	6.531	5.657	52.93	105.34	52.41
21	120344	6.300	9.634	5.769	0.343	-1.554	5.821	6.531	5.660	52.89	105.26	52.37
22	120358	6.128	11.553	9.623	4.375	0.269	5.822	6.530	5.660	52.86	105.20	52.34
23	120415	3.980	10.771	11.907	8.021	2.961	5.821	6.530	5.659	52.80	105.09	52.29
24	120435	1.776	7.283	11.518	10.406	5.225	5.822	6.530	5.660	52.77	105.02	52.25
25	120450	-0.468	2.652	8.127	10.167	6.583	5.822	6.530	5.662	52.75	104.98	52.23
26	120505	-1.282	0.146	3.929	7.043	5.830	5.822	6.531	5.664	52.70	104.90	52.20
27	120521	-0.303	0.188	1.282	2.973	3.123	5.822	6.531	5.664	52.67	104.83	52.16
28	120543	0.941	0.397	1.758	3.101	2.810	5.821	6.531	5.663	52.61	104.76	52.15
29	120603	0.001	0.949	4.485	6.852	5.133	5.822	6.529	5.665	52.55	104.65	52.10
30	120621	0.393	3.426	8.041	9.681	5.771	5.821	6.528	5.666	52.54	104.63	52.09
31	120636	1.788	6.826	10.786	9.618	4.960	5.822	6.527	5.668	52.52	104.62	52.10
32	120654	4.222	9.932	10.749	7.643	2.625	5.822	6.526	5.666	52.50	104.55	52.05
33	120710	5.432	10.925	9.352	4.112	0.252	5.823	6.525	5.666	52.45	104.46	52.01
34	120728	6.183	8.980	5.332	0.599	-1.329	5.821	6.524	5.667	52.44	104.46	52.02
35	120748	4.934	4.691	1.063	-1.632	-1.914	5.822	6.523	5.669	52.40	104.37	51.97
36	120804	2.129	0.816	-0.772	-0.882	-0.804	5.821	6.523	5.667	52.37	104.31	51.94
	120921	0.000	0.000	0.000	0.000	0.000	6.057	6.800	5.887	55.67	110.81	55.14
	120945	0.015	0.016	-0.007	-0.004	-0.009	6.291	7.050	6.083	57.79	115.03	57.24

Beam B-2 - November 19, 1991

											Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	121051	0.008	0.017	-0.010	0.001	-0.009	6.646	7.458	6.507	59.97	119.32	59.35
1	121228	-3.098	-1.440	1.186	1.781	1.043	6.675	7.473	6.522	58.70	116.59	57.89
2	121252	-5.602	-6.387	-0.747	2.877	2.084	6.675	7.474	6.524	58.50	116.19	57.69
3	121322	-8.006	-11.916	-7.035	-0.185	2.031	6.673	7.476	6.524	58.23	115.61	57.38
4	121340	-5.977	-13.123	-12.051	-4.618	0.304	6.673	7.475	6.524	58.22	115.58	57.36
5	121355	-5.590	-9.464	-14.011	-8.467	-2.228	6.673	7.475	6.525	58.17	115.46	57.29
6	121409	0.569	-4.855	-13.831	-11.600	-4.287	6.674	7.475	6.523	58.08	115.30	57.22
7	121426	1.849	-0.367	-13.720	-10.533	-7.006	6.674	7.475	6.523	58.00	115.13	57.13
8	121444	1.899	2.090	-2.205	-6.458	-6.750	6.673	7.475	6.525	57.87	114.89	57.02
9	121457	1.530	2.077	0.170	-2.304	-3.091	6.675	7.475	6.522	57.84	114.83	56.99
10	121518	2.104	2.732	0.654	-1.653	-2.944	6.673	7.475	6.520	57.75	114.69	56.94
11	121535	2.779	2.531	-2.628	-6.284	-6.477	6.673	7.476	6.524	57.62	114.43	56.81
12	121550	2.399	-0.305	-7.573	-10.302	-7.389	6.673	7.476	6.524	57.60	114.39	56.79
13	121605	0.673	-5.197	-11.901	-11.406	-5.689	6.673	7.475	6.524	57.66	114.52	56.86
14	121630	-1.811	-9.643	-14.009	-9.035	-2.719	6.673	7.475	6.527	57.57	114.36	56.79
15	121703	-5.626	-13.275	-11.929	-4.642	0.884	6.675	7.475	6.524	57.46	114.15	56.69
16	121719	-8.313	-12.743	-6.951	-0.027	2.570	6.673	7.475	6.527	57.41	114.04	56.63
17	121740	-7.050	-7.235	-1.253	2.648	2.400	6.673	7.475	6.525	57.36	113.93	56.57
18	121755	-3.709	-2.023	1.106	1.889	0.698	6.673	7.475	6.525	57.31	113.84	56.53
19	121825	3.381	2.589	-0.173	-0.311	0.576	6.673	7.475	6.525	57.36	113.80	56.44
20	121843	6.385	6.658	2.005	-1.744	-0.868	6.673	7.475	6.527	57.31	113.70	56.39
21	121900	7.333	11.302	6.072	0.039	-2.228	6.673	7.475	6.527	57.28	113.64	56.36
22	121917	6.639	13.347	10.614	4.399	-0.249	6.673	7.475	6.527	57.22	113.52	56.30
23	121934	3.751	11.710	13.325	8.682	2.819	6.673	7.475	6.527	57.17	113.43	56.26
24	121949	0.930	7.603	12.935	11.535	5.493	6.674	7.475	6.526	57.13	113.36	56.23
25	122005	-1.517	1.776	8.182	11.440	7.331	6.672	7.475	6.527	57.08	113.26	56.18
26	122019	-1.773	-0.796	3.352	7.922	6.697	6.673	7.475	6.527	57.05	113.20	56.15
27	122036	-0.455	-0.475	0.525	3.159	3.666	6.673	7.475	6.527	57.02	113.15	56.13
28	122055	0.547	-0.255	1.181	2.915	3.671	6.674	7.475	6.527	56.96	113.10	56.14
29	122110	-0.522	-0.275	4.005	7.622	6.417	6.673	7.475	6.525	56.93	113.02	56.09
30	122125	-0.493	2.438	8.488	11.100	6.956	6.673	7.475	6.527	56.93	113.02	56.09
31	122139	1.212	6.778	12.322	11.094	5.914	6.673	7.475	6.526	56.88	112.92	56.04
32	122159	3.833	11.120	14.003	9.097	3.012	6.674	7.475	6.527	56.85	112.86	56.01
33	122215	6.025	14.122	11.654	4.954	0.149	6.673	7.475	6.528	56.83	112.82	55.99
34	122230	8.220	11.836	6.183	0.765	-1.552	6.674	7.475	6.527	56.81	112.79	55.98
35	122246	7.018	6.187	1.027	-1.776	-2.090	6.674	7.475	6.526	56.74	112.67	55.93
36	122259	3.106	0.787	-1.123	-1.361	-0.821	6.673	7.475	6.527	56.73	112.64	55.91
	122406	-0.003	0.097	-0.071	-0.019	-0.005	6.870	7.711	6.697	58.92	116.90	57.98
	122422	-0.008	0.026	0.025	0.060	-0.030	7.022	7.949	7.015	60.88	120.78	59.90
	122443	-0.060	0.072	-0.069	-0.003	0.016	7.276	8.188	7.170	62.16	123.23	61.07
	122719	-0.019	0.040	-0.042	0.013	0.064	1.695	2.064	2.315	0.62	1.19	0.57

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN) Shear	Forces (kN) Load	Forces (kN) Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	135021	0.000	0.000	0.000	0.000	0.000	-0.013	-1.150	-0.001	0.38	0.72	0.34
1	135046	-0.328	-0.597	-0.881	-0.725	-0.576	-0.013	-1.150	-0.002	0.44	0.79	0.35
2	135102	-0.371	-0.816	-1.311	-1.032	-0.665	-0.013	-1.152	-0.003	0.45	0.80	0.35
3	135118	-0.551	-1.017	-1.495	-1.166	-0.781	-0.014	-1.153	-0.001	0.44	0.79	0.35
4	135132	-0.623	-1.253	-1.508	-1.180	-0.772	-0.014	-1.154	-0.001	0.45	0.80	0.35
5	135144	-0.823	-1.043	-1.314	-0.996	-0.806	-0.015	-1.154	-0.004	0.44	0.79	0.35
6	135159	-0.248	-0.689	-0.991	-0.895	-0.724	-0.016	-1.154	-0.001	0.44	0.80	0.36
7	135218	0.082	-0.086	-0.797	-0.608	-0.578	-0.016	-1.154	-0.005	0.45	0.81	0.36
8	135232	0.287	0.310	-0.374	-0.250	-0.151	-0.015	-1.155	-0.003	0.43	0.79	0.36
9	135247	0.972	0.701	0.300	0.221	0.158	-0.015	-1.155	-0.002	0.43	0.79	0.36
10	135304	1.349	1.702	1.671	1.608	1.280	-0.017	-1.155	-0.002	0.41	0.80	0.39
11	135324	0.743	1.231	1.327	1.231	1.040	-0.015	-1.156	-0.006	0.40	0.79	0.39
12	135339	0.248	0.545	0.587	0.710	0.560	-0.017	-1.156	-0.002	0.39	0.77	0.38
13	135353	0.120	0.286	0.341	0.358	0.547	-0.017	-1.156	-0.003	0.40	0.79	0.39
14	135407	-0.015	0.052	0.062	0.147	0.326	-0.018	-1.157	-0.003	0.39	0.78	0.39
15	135424	-0.053	-0.033	-0.345	0.011	0.118	-0.018	-1.157	-0.003	0.39	0.79	0.40
16	135439	-0.267	0.288	0.324	0.206	0.139	-0.018	-1.157	-0.002	0.39	0.79	0.40
17	135454	0.327	0.834	0.652	0.395	0.115	-0.017	-1.158	-0.006	0.38	0.78	0.40
18	135508	0.529	0.894	0.813	0.529	0.203	-0.019	-1.158	-0.003	0.38	0.78	0.40
19	135533	-0.297	-0.164	-0.129	0.066	0.611	-0.040	-1.163	-0.005	0.45	0.80	0.35
20	135545	-0.015	0.055	0.026	0.239	0.672	-0.040	-1.163	-0.006	0.43	0.78	0.35
21	135601	0.300	0.339	0.019	0.640	0.922	-0.034	-1.204	-0.018	0.47	0.88	0.41
22	135615	0.365	0.485	0.610	0.908	1.100	-0.036	-1.204	-0.020	0.46	0.86	0.40
23	135631	0.401	0.547	0.798	1.079	1.147	-0.037	-1.204	-0.020	0.46	0.86	0.40
24	135644	0.408	0.662	0.953	1.212	1.257	-0.036	-1.204	-0.020	0.45	0.86	0.41
25	135658	0.290	0.572	0.836	1.078	1.048	-0.035	-1.205	-0.018	0.45	0.86	0.41
26	135715	0.418	0.795	0.984	1.237	1.281	-0.035	-1.205	-0.019	0.48	0.91	0.43
27	135730	0.542	0.711	0.648	1.077	1.178	-0.036	-1.205	-0.019	0.47	0.90	0.43
28	135751	0.332	0.252	-0.012	0.123	0.401	-0.035	-1.268	-0.013	0.41	0.84	0.43
29	135803	0.281	0.161	-0.819	0.206	0.587	-0.035	-1.268	-0.015	0.40	0.82	0.42
30	135817	0.267	0.312	0.239	0.589	0.794	-0.035	-1.268	-0.016	0.40	0.83	0.43
31	135831	0.440	1.083	0.598	1.170	1.244	-0.035	-1.268	-0.017	0.40	0.83	0.43
32	135846	1.024	1.368	1.491	1.426	1.068	-0.036	-1.268	-0.016	0.38	0.81	0.43
33	135905	1.081	1.560	1.798	1.675	1.299	-0.035	-1.268	-0.015	0.39	0.81	0.42
34	135920	1.110	1.541	1.806	1.797	1.296	-0.037	-1.268	-0.016	0.39	0.81	0.42
35	135933	0.944	1.312	1.733	1.770	1.486	-0.036	-1.268	-0.016	0.39	0.83	0.44
36	135948	0.540	0.911	1.194	1.391	1.315	-0.036	-1.268	-0.014	0.39	0.82	0.43
	140116	0.000	0.000	0.000	0.000	0.000	0.111	-0.961	0.067	2.68	5.34	2.66
	140134	-0.012	-0.006	0.009	0.014	-0.004	0.373	-0.658	0.373	5.35	10.69	5.34
	140148	-0.021	-0.007	0.017	0.039	-0.009	0.736	-0.351	0.570	8.22	16.47	8.25

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	140203	-0.027	-0.007	0.026	0.067	-0.016	0.895	-0.127	0.866	10.32	20.67	10.35
1	140242	-0.171	-0.451	-0.796	-0.724	-0.486	0.896	-0.125	0.865	10.16	20.30	10.14
2	140255	-0.307	-0.801	-1.365	-1.153	-0.746	0.897	-0.125	0.864	10.13	20.23	10.10
3	140306	-0.469	-1.015	-1.608	-1.348	-0.893	0.899	-0.125	0.862	10.10	20.19	10.09
4	140326	-0.473	-1.221	-1.649	-1.450	-0.778	0.897	-0.125	0.865	10.07	20.13	10.06
5	140341	-0.732	-1.087	-1.540	-1.358	-0.897	0.897	-0.125	0.862	10.03	20.06	10.03
6	140356	-0.094	-0.635	-1.204	-1.189	-0.822	0.898	-0.125	0.864	10.06	20.09	10.03
7	140410	0.228	0.060	-0.880	-0.809	-0.644	0.899	-0.125	0.866	10.03	20.06	10.03
8	140430	0.470	0.488	-0.330	-0.370	-0.266	0.901	-0.124	0.866	10.01	20.02	10.01
9	140451	1.114	0.871	0.297	0.046	0.088	0.902	-0.123	0.868	10.01	20.01	10.00
10	140506	1.471	1.863	1.731	1.519	1.471	0.902	-0.123	0.865	9.96	19.98	10.02
11	140524	1.016	1.466	1.419	1.153	0.933	0.901	-0.123	0.866	9.96	19.98	10.02
12	140541	0.541	0.902	0.671	0.741	0.466	0.901	-0.123	0.868	9.93	19.93	10.00
13	140557	0.328	0.654	0.490	0.375	0.417	0.901	-0.123	0.865	9.94	19.96	10.02
14	140609	0.211	0.393	0.228	0.238	0.185	0.901	-0.123	0.866	9.93	19.94	10.01
15	140623	0.155	0.327	-0.093	0.205	0.041	0.901	-0.123	0.866	9.92	19.92	10.00
16	140640	-0.106	0.535	0.451	0.337	0.007	0.902	-0.123	0.866	9.90	19.88	9.98
17	140656	0.414	1.033	0.614	0.449	-0.088	0.902	-0.123	0.868	9.92	19.92	10.00
18	140710	0.557	1.016	0.776	0.490	-0.052	0.902	-0.123	0.869	9.92	19.92	10.00
19	140736	-0.284	-0.109	-0.248	-0.000	0.504	0.900	-0.123	0.869	9.95	19.87	9.92
20	140753	0.237	0.202	-0.107	0.032	0.437	0.902	-0.123	0.868	9.93	19.84	9.91
21	140808	0.290	0.299	0.228	0.315	0.623	0.902	-0.123	0.865	9.91	19.81	9.90
22	140827	0.397	0.449	0.323	0.681	0.857	0.901	-0.123	0.869	9.91	19.81	9.90
23	140847	0.405	0.582	0.535	0.856	0.887	0.901	-0.123	0.868	9.88	19.76	9.88
24	140904	0.398	0.620	0.568	0.908	0.998	0.901	-0.122	0.868	9.89	19.78	9.89
25	140922	0.279	0.591	0.626	0.854	0.821	0.902	-0.123	0.865	9.89	19.78	9.89
26	140939	0.343	0.646	0.626	0.767	0.753	0.902	-0.123	0.865	9.85	19.71	9.86
27	140955	0.838	0.810	0.580	0.973	1.019	0.902	-0.123	0.869	9.86	19.72	9.86
28	141011	0.188	-0.018	-0.139	0.063	0.152	0.902	-0.123	0.865	9.83	19.72	9.89
29	141028	0.153	-0.104	-1.196	0.011	0.283	0.901	-0.123	0.866	9.81	19.68	9.87
30	141047	0.155	0.075	-0.101	0.402	0.660	0.901	-0.123	0.867	9.81	19.71	9.90
31	141106	0.393	0.959	0.573	1.119	1.232	0.901	-0.123	0.865	9.81	19.68	9.87
32	141133	0.621	1.181	0.796	1.125	0.962	0.901	-0.122	0.865	9.80	19.66	9.86
33	141149	0.592	1.184	1.350	1.086	0.965	0.901	-0.122	0.865	9.80	19.68	9.88
34	141206	0.615	1.146	1.413	1.177	1.010	0.901	-0.123	0.866	9.79	19.66	9.87
35	141222	0.747	0.937	1.283	1.143	1.012	0.902	-0.123	0.869	9.78	19.64	9.86
36	141243	0.550	0.809	1.005	1.280	0.957	0.902	-0.123	0.865	9.78	19.65	9.87
	141335	0.000	0.000	0.000	0.000	0.000	1.220	0.169	1.010	13.14	26.32	13.18
	141352	0.008	0.001	-0.020	0.062	0.003	1.403	0.398	1.247	15.59	31.20	15.61
	141412	0.036	-0.060	-0.029	0.042	0.060	1.624	0.635	1.439	17.88	35.76	17.88

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	141433	-0.051	-0.053	-0.021	0.047	0.067	1.872	0.873	1.601	20.24	40.45	20.21
1	141507	-0.223	-0.668	-0.867	-0.468	-0.337	1.920	0.931	1.681	20.68	41.25	20.57
2	141524	-0.560	-1.099	-1.474	-0.964	-0.567	1.919	0.931	1.680	20.60	41.11	20.51
3	141539	-0.731	-1.381	-1.858	-1.228	-0.779	1.919	0.931	1.684	20.54	40.99	20.45
4	141554	-0.716	-1.489	-2.023	-1.479	-0.833	1.919	0.931	1.680	20.48	40.87	20.39
5	141613	-0.694	-1.529	-1.943	-1.282	-1.182	1.919	0.931	1.684	20.44	40.80	20.36
6	141631	-0.016	-1.105	-1.632	-1.168	-1.190	1.919	0.931	1.684	20.40	40.72	20.32
7	141646	0.241	-0.247	-1.116	-0.694	-0.928	1.920	0.931	1.682	20.35	40.63	20.28
8	141703	0.533	0.381	-0.383	-0.163	-0.519	1.919	0.931	1.684	20.34	40.62	20.28
9	141717	0.976	0.840	0.319	0.263	0.086	1.918	0.931	1.683	20.32	40.57	20.25
10	141733	1.296	1.777	1.769	1.766	1.566	1.919	0.931	1.684	20.24	40.46	20.22
11	141747	0.679	1.332	1.607	1.346	1.080	1.919	0.931	1.684	20.24	40.46	20.22
12	141803	0.434	1.166	1.060	1.162	0.636	1.919	0.931	1.683	20.21	40.40	20.19
13	141816	0.212	0.874	0.883	0.825	0.546	1.919	0.931	1.686	20.20	40.39	20.19
14	141832	0.133	0.679	0.649	0.703	0.442	1.918	0.931	1.684	20.15	40.31	20.16
15	141846	0.110	0.484	0.256	0.755	0.249	1.919	0.931	1.686	20.18	40.36	20.18
16	141901	-0.261	0.561	0.781	0.749	0.180	1.919	0.931	1.684	20.16	40.34	20.18
17	141914	0.206	0.965	0.872	0.867	-0.003	1.918	0.931	1.683	20.15	40.31	20.16
18	141928	0.251	0.793	0.822	0.452	-0.001	1.917	0.931	1.683	20.13	40.27	20.14
19	141954	-0.502	-0.204	-0.213	0.060	0.653	1.919	0.931	1.684	20.19	40.25	20.06
20	142008	-0.079	-0.104	-0.225	0.094	0.567	1.919	0.931	1.684	20.14	40.19	20.05
21	142025	-0.035	-0.093	-0.006	0.262	0.551	1.920	0.931	1.684	20.12	40.15	20.03
22	142041	-0.043	-0.134	-0.049	0.371	0.704	1.919	0.931	1.684	20.12	40.15	20.03
23	142055	0.058	0.228	0.009	0.609	0.719	1.919	0.931	1.686	20.12	40.15	20.03
24	142109	0.027	0.194	0.356	0.624	0.851	1.917	0.931	1.684	20.09	40.11	20.02
25	142124	-0.074	0.274	0.440	0.660	0.734	1.919	0.931	1.686	20.07	40.06	19.99
26	142139	0.121	0.408	0.577	0.947	0.715	1.919	0.931	1.684	20.06	40.05	19.99
27	142158	0.303	0.558	0.584	0.880	1.044	1.920	0.931	1.686	20.06	40.05	19.99
28	142216	-0.221	-0.303	-0.274	-0.167	0.217	1.919	0.931	1.687	20.01	39.99	19.98
29	142229	-0.008	-0.284	-1.352	0.090	0.308	1.919	0.931	1.686	19.99	39.96	19.97
30	142245	-0.161	-0.368	-0.381	0.464	0.592	1.920	0.931	1.687	19.96	39.91	19.95
31	142301	0.152	0.440	0.524	1.269	1.175	1.920	0.931	1.688	19.96	39.92	19.96
32	142316	0.777	0.820	0.928	1.611	0.983	1.920	0.931	1.688	19.95	39.89	19.94
33	142329	0.803	0.991	1.405	1.708	1.194	1.920	0.931	1.686	19.95	39.90	19.95
34	142343	0.788	0.928	1.331	1.638	0.963	1.919	0.931	1.688	19.93	39.86	19.93
35	142400	0.689	0.764	1.294	1.617	1.002	1.919	0.931	1.687	19.94	39.89	19.95
36	142419	0.393	0.670	0.977	1.413	1.056	1.919	0.931	1.688	19.94	39.91	19.97
	142546	0.000	0.000	0.000	0.000	0.000	2.138	1.201	1.945	23.40	46.75	23.35
	142601	-0.003	0.000	-0.007	-0.007	-0.003	2.393	1.430	2.175	25.94	51.75	25.81
	142612	0.013	-0.003	0.003	-0.012	-0.003	2.542	1.616	2.365	27.98	55.80	27.82

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	142629	-0.010	0.001	-0.021	-0.036	-0.014	2.790	1.860	2.570	30.58	60.95	30.37
1	142710	-0.458	-0.769	-0.982	-0.448	-0.291	2.790	1.862	2.571	30.17	60.06	29.89
2	142724	-0.697	-1.527	-1.746	-0.919	-0.506	2.790	1.862	2.572	30.09	59.90	29.81
3	142736	-1.040	-1.986	-2.442	-1.355	-0.670	2.790	1.862	2.571	30.06	59.84	29.78
4	142749	-0.860	-2.221	-2.836	-1.971	-0.929	2.790	1.862	2.571	30.01	59.75	29.74
5	142804	-0.939	-2.027	-2.919	-2.109	-1.226	2.789	1.862	2.570	29.95	59.62	29.67
6	142819	-0.043	-1.181	-2.389	-1.897	-1.289	2.790	1.862	2.569	29.89	59.51	29.62
7	142835	0.457	0.011	-1.592	-1.255	-1.092	2.790	1.862	2.572	29.86	59.46	29.60
8	142851	0.417	0.609	-0.610	-0.517	-0.630	2.790	1.862	2.572	29.83	59.40	29.57
9	142905	0.996	0.930	0.381	0.185	-0.016	2.789	1.863	2.571	29.76	59.28	29.52
10	142922	1.375	1.789	1.851	1.926	1.556	2.791	1.863	2.571	29.71	59.21	29.50
11	142944	0.835	1.761	1.944	1.886	1.246	2.791	1.863	2.571	29.68	59.16	29.48
12	143003	0.499	1.572	1.668	1.615	0.876	2.790	1.863	2.572	29.65	59.10	29.45
13	143022	0.525	1.481	1.477	1.315	0.767	2.790	1.863	2.569	29.62	59.04	29.42
14	143038	0.412	1.242	1.275	1.207	0.605	2.791	1.863	2.574	29.60	59.00	29.40
15	143054	0.355	1.149	0.824	1.196	0.481	2.790	1.863	2.571	29.59	58.98	29.39
16	143111	-0.168	1.001	1.162	0.727	0.276	2.789	1.863	2.572	29.56	58.93	29.37
17	143128	0.343	1.335	1.091	0.537	-0.347	2.790	1.863	2.573	29.54	58.89	29.35
18	143143	0.404	0.992	0.952	0.423	-0.311	2.790	1.863	2.573	29.53	58.88	29.35
19	143211	-0.528	0.408	-0.350	-0.140	0.347	2.790	1.863	2.572	29.60	58.88	29.28
20	143228	-0.236	-0.440	-0.460	-0.159	0.292	2.791	1.863	2.571	29.56	58.82	29.26
21	143248	-0.281	-0.928	-0.862	-0.138	0.535	2.790	1.863	2.571	29.55	58.81	29.26
22	143304	-0.226	-0.979	-0.960	-0.241	0.420	2.790	1.863	2.573	29.53	58.76	29.23
23	143321	-0.157	-0.632	-1.112	-0.301	0.357	2.790	1.863	2.573	29.51	58.74	29.23
24	143337	0.099	-0.086	-0.521	-0.193	0.162	2.790	1.863	2.572	29.46	58.65	29.19
25	143354	0.206	0.305	-0.038	0.079	0.182	2.790	1.863	2.572	29.47	58.67	29.20
26	143412	0.188	0.569	0.428	0.329	0.197	2.789	1.863	2.573	29.43	58.60	29.17
27	143428	0.697	0.682	0.556	0.776	0.665	2.790	1.863	2.572	29.42	58.58	29.16
28	143452	-0.037	-0.264	-0.343	-0.204	0.039	2.790	1.863	2.572	29.39	58.59	29.20
29	143511	-0.316	-0.670	-1.743	-0.587	0.097	2.790	1.863	2.575	29.37	58.55	29.18
30	143526	-0.441	-0.748	-0.782	0.029	0.263	2.790	1.863	2.572	29.34	58.49	29.15
31	143544	-0.198	-0.123	0.177	1.044	1.244	2.791	1.863	2.573	29.34	58.48	29.14
32	143604	0.495	0.644	1.020	1.421	0.875	2.790	1.863	2.574	29.34	58.48	29.14
33	143621	0.574	0.844	1.248	1.400	1.013	2.790	1.863	2.572	29.30	58.41	29.11
34	143637	0.661	0.845	1.245	1.522	0.851	2.790	1.863	2.573	29.29	58.39	29.10
35	143657	0.529	0.633	1.155	1.271	0.956	2.790	1.863	2.575	29.26	58.34	29.08
36	143714	0.230	0.632	0.977	1.188	0.964	2.790	1.863	2.575	29.28	58.38	29.10
	143814	0.000	0.000	0.000	0.000	0.000	3.048	2.128	2.681	32.85	65.40	32.55

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	143836	-0.010	0.004	-0.007	0.014	-0.006	3.254	2.373	3.009	35.65	70.96	35.31
1	143928	-0.496	-1.246	-1.195	-0.711	-0.403	3.262	2.385	3.016	35.45	70.49	35.04
2	143944	-1.096	-2.281	-2.089	-1.073	-0.430	3.262	2.385	3.014	35.38	70.36	34.98
3	144004	-1.385	-2.965	-3.128	-1.751	-0.763	3.263	2.385	3.015	35.29	70.19	34.90
4	144021	-1.336	-3.423	-3.930	-2.641	-0.958	3.262	2.386	3.015	35.27	70.14	34.87
5	144039	-1.313	-3.035	-4.175	-3.219	-1.718	3.261	2.385	3.018	35.20	70.01	34.81
6	144057	-0.272	-1.848	-3.487	-3.030	-1.792	3.262	2.385	3.014	35.15	69.91	34.76
7	144116	0.330	-0.281	-2.322	-2.264	-1.527	3.261	2.386	3.014	35.11	69.84	34.73
8	144132	0.441	0.509	-0.825	-1.232	-0.926	3.263	2.386	3.018	35.10	69.81	34.71
9	144151	1.026	0.757	0.331	-0.246	-0.136	3.262	2.385	3.016	35.08	69.76	34.68
10	144209	1.211	1.607	1.971	1.808	1.550	3.262	2.386	3.016	34.98	69.62	34.64
11	144225	0.824	1.719	2.456	2.113	1.292	3.262	2.386	3.015	34.97	69.61	34.64
12	144246	0.561	1.861	2.581	2.081	1.044	3.262	2.386	3.016	34.97	69.61	34.64
13	144306	0.717	2.152	2.620	1.843	1.135	3.263	2.386	3.018	34.91	69.49	34.58
14	144326	0.752	2.065	2.457	1.615	0.784	3.263	2.386	3.018	34.88	69.43	34.55
15	144348	0.716	1.936	1.794	1.267	0.434	3.263	2.386	3.018	34.85	69.39	34.54
16	144405	0.226	1.779	1.889	0.901	0.118	3.262	2.386	3.016	34.84	69.38	34.54
17	144425	0.624	1.738	1.391	0.552	-0.150	3.262	2.386	3.018	34.79	69.28	34.49
18	144442	0.500	1.068	0.993	0.365	-0.196	3.262	2.386	3.018	34.79	69.27	34.48
19	144506	-0.622	-0.619	-0.409	-0.069	0.670	3.262	2.386	3.019	34.84	69.26	34.42
20	144522	-0.710	-1.398	-1.113	-0.255	1.171	3.262	2.386	3.016	34.82	69.23	34.41
21	144538	-0.902	-2.543	-2.099	-0.634	0.729	3.261	2.387	3.017	34.83	69.24	34.41
22	144552	-0.903	-2.952	-2.990	-1.273	0.387	3.264	2.387	3.017	34.78	69.16	34.38
23	144611	-0.628	-2.431	-3.368	-1.907	-0.049	3.262	2.387	3.018	34.77	69.14	34.37
24	144624	0.032	-1.211	-2.537	-1.951	-0.204	3.262	2.387	3.016	34.74	69.08	34.34
25	144638	0.340	-0.116	-1.399	-1.473	-0.359	3.264	2.387	3.017	34.75	69.11	34.36
26	144651	0.295	0.567	-0.345	-0.578	-0.066	3.263	2.387	3.018	34.69	69.00	34.31
27	144706	0.841	0.653	0.481	0.546	0.767	3.263	2.387	3.018	34.67	68.97	34.30
28	144722	-0.010	-0.492	-0.581	-0.468	0.154	3.263	2.387	3.018	34.64	68.97	34.33
29	144736	-0.418	-1.138	-2.312	-0.908	0.241	3.263	2.387	3.018	34.62	68.95	34.33
30	144750	-0.633	-1.426	-1.505	-0.319	0.717	3.263	2.387	3.018	34.63	68.97	34.34
31	144808	-0.491	-0.800	-0.312	0.927	1.568	3.263	2.387	3.018	34.62	68.92	34.30
32	144823	0.216	0.143	0.853	1.601	1.545	3.262	2.387	3.019	34.62	68.92	34.30
33	144842	0.456	0.641	0.876	1.631	1.349	3.263	2.387	3.016	34.61	68.92	34.31
34	144859	0.683	0.842	1.430	1.545	1.131	3.263	2.388	3.018	34.56	68.82	34.26
35	144914	0.374	0.614	1.316	1.380	1.109	3.263	2.388	3.018	34.58	68.86	34.28
36	144930	0.258	0.600	1.012	1.108	1.255	3.262	2.388	3.020	34.57	68.85	34.28
	145029	0.000	0.000	0.000	0.000	0.000	3.521	2.648	3.149	37.93	75.49	37.56

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	145054	0.000	0.000	0.000	0.000	0.000	3.737	2.894	3.440	40.54	80.70	40.16
1	145212	-0.784	-1.310	-1.118	-0.339	-0.325	3.738	2.906	3.445	40.14	79.83	39.69
2	145226	-1.527	-2.804	-2.274	-0.655	-0.074	3.739	2.906	3.445	40.10	79.75	39.65
3	145242	-1.928	-4.040	-3.889	-1.621	-0.390	3.738	2.906	3.445	40.05	79.66	39.61
4	145258	-1.848	-4.491	-5.151	-3.028	-0.983	3.738	2.906	3.443	40.01	79.56	39.55
5	145316	-1.622	-4.057	-5.617	-3.968	-1.804	3.739	2.906	3.445	39.97	79.49	39.52
6	145336	-0.187	-2.313	-4.800	-3.909	-2.361	3.739	2.907	3.445	39.90	79.38	39.48
7	145350	0.387	-0.269	-3.138	-3.292	-2.237	3.739	2.907	3.445	39.92	79.38	39.46
8	145405	0.807	0.929	-1.059	-1.605	-1.512	3.739	2.907	3.445	39.87	79.29	39.42
9	145423	1.233	1.129	0.241	-0.128	-0.475	3.739	2.907	3.445	39.84	79.23	39.39
10	145446	1.305	1.639	2.179	2.553	1.988	3.739	2.907	3.443	39.74	79.11	39.37
11	145504	0.747	1.984	3.250	3.469	1.993	3.739	2.907	3.445	39.72	79.07	39.35
12	145520	0.754	2.518	4.125	3.998	1.954	3.739	2.907	3.445	39.70	79.04	39.34
13	145538	1.044	3.491	4.653	3.851	1.778	3.738	2.907	3.444	39.68	79.01	39.33
14	145555	1.490	3.913	4.688	3.467	1.189	3.737	2.907	3.444	39.63	78.92	39.29
15	145611	1.573	4.049	4.036	2.850	1.405	3.738	2.908	3.443	39.63	78.92	39.29
16	145629	0.819	3.246	3.094	1.330	0.121	3.739	2.908	3.443	39.60	78.87	39.27
17	145644	0.995	2.680	1.899	0.523	-0.405	3.739	2.908	3.445	39.56	78.80	39.24
18	145704	0.533	1.280	1.035	0.269	-0.199	3.739	2.908	3.445	39.56	78.79	39.23
19	145732	-0.883	-0.760	-0.335	0.437	1.110	3.738	2.908	3.445	39.59	78.73	39.14
20	145750	-1.239	-2.098	-1.355	0.267	1.328	3.738	2.908	3.443	39.56	78.69	39.13
21	145806	-1.770	-3.910	-2.973	-0.515	1.002	3.738	2.909	3.446	39.57	78.69	39.12
22	145822	-1.653	-4.455	-4.526	-1.641	0.615	3.739	2.909	3.446	39.54	78.65	39.11
23	145838	-1.142	-3.806	-5.453	-3.105	-0.438	3.739	2.909	3.445	39.51	78.59	39.08
24	145858	-0.075	-2.049	-4.633	-3.537	-1.157	3.739	2.909	3.445	39.46	78.50	39.04
25	145920	0.409	-0.344	-2.894	-3.166	-1.565	3.739	2.909	3.445	39.46	78.51	39.05
26	145938	0.516	0.842	-0.707	-1.620	-1.160	3.739	2.909	3.445	39.41	78.41	39.00
27	145959	0.587	0.932	0.505	0.198	0.239	3.739	2.909	3.445	39.41	78.41	39.00
28	150022	-0.166	-0.546	-0.849	-0.738	-0.150	3.737	2.909	3.444	39.35	78.38	39.03
29	150041	-0.645	-1.574	-3.149	-1.669	-0.167	3.739	2.910	3.446	39.34	78.34	39.00
30	150059	-1.160	-2.371	-2.747	-1.095	0.318	3.739	2.910	3.447	39.33	78.34	39.01
31	150116	-0.831	-1.691	-1.377	0.737	1.562	3.739	2.911	3.446	39.27	78.22	38.95
32	150131	-0.571	-0.929	0.320	1.872	1.702	3.740	2.911	3.446	39.25	78.18	38.93
33	150149	-0.149	0.295	1.562	2.385	1.809	3.739	2.911	3.448	39.23	78.14	38.91
34	150209	0.434	0.981	2.124	2.294	1.327	3.739	2.911	3.445	39.23	78.13	38.90
35	150223	0.286	0.923	1.912	1.819	1.096	3.739	2.911	3.445	39.22	78.10	38.88
36	150240	0.207	0.783	1.239	1.337	1.095	3.739	2.911	3.446	39.20	78.08	38.88
	150347	0.000	0.000	0.000	0.000	0.000	4.054	3.238	3.673	43.15	85.91	42.76

Beam B-3 - November 20, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	Shear A/F - B/E	Load Mid	Shear B/E - C/D
	150400	0.000	0.000	0.000	0.000	0.000	4.267	3.498	3.861	45.76	91.15	45.39
1	150513	-1.150	-1.687	-1.089	-0.111	-0.231	4.269	3.505	3.864	45.17	89.90	44.73
2	150527	-2.289	-3.900	-2.617	-0.392	0.214	4.268	3.505	3.864	45.03	89.65	44.62
3	150542	-2.829	-5.534	-4.819	-1.575	-0.002	4.267	3.505	3.864	44.99	89.57	44.58
4	150557	-2.541	-6.161	-6.622	-3.567	-1.009	4.268	3.506	3.866	44.95	89.49	44.54
5	150613	-1.960	-5.413	-7.364	-5.056	-2.250	4.269	3.506	3.864	44.89	89.37	44.48
6	150632	-0.201	-2.828	-6.238	-5.273	-3.047	4.268	3.506	3.866	44.82	89.25	44.43
7	150647	0.723	-0.284	-4.045	-4.548	-3.158	4.269	3.506	3.864	44.77	89.15	44.38
8	150706	0.843	1.023	-1.521	-2.694	-2.325	4.269	3.506	3.868	44.72	89.06	44.34
9	150723	1.234	1.180	0.420	-0.344	-0.922	4.269	3.506	3.867	44.71	89.02	44.31
10	150744	0.876	1.255	2.238	2.822	2.343	4.267	3.506	3.868	44.62	88.90	44.28
11	150800	0.289	1.689	3.951	4.855	2.725	4.266	3.507	3.864	44.58	88.83	44.25
12	150815	0.145	2.904	5.541	5.532	2.817	4.269	3.507	3.868	44.54	88.75	44.21
13	150831	1.030	4.659	6.790	5.486	2.676	4.269	3.507	3.868	44.53	88.73	44.20
14	150846	1.944	5.717	7.023	4.613	1.622	4.269	3.507	3.864	44.50	88.68	44.18
15	150900	2.491	5.882	5.571	3.171	0.684	4.269	3.507	3.868	44.47	88.63	44.16
16	150920	1.771	5.034	4.263	1.504	-0.234	4.267	3.507	3.868	44.44	88.59	44.15
17	150938	1.882	3.864	2.277	0.300	-0.769	4.267	3.507	3.866	44.41	88.52	44.11
18	150952	1.040	1.700	1.077	0.177	-0.365	4.267	3.507	3.868	44.36	88.41	44.05
19	151024	-1.173	-1.064	-0.256	0.666	1.229	4.268	3.508	3.869	44.41	88.38	43.97
20	151040	-2.101	-3.072	-1.598	0.678	1.671	4.269	3.508	3.869	44.40	88.38	43.98
21	151054	-2.655	-5.545	-3.796	-0.405	1.453	4.267	3.508	3.868	44.35	88.29	43.94
22	151109	-2.377	-6.335	-6.118	-2.301	0.603	4.268	3.508	3.869	44.33	88.27	43.94
23	151127	-1.380	-5.374	-7.425	-4.202	-0.867	4.268	3.508	3.867	44.29	88.18	43.89
24	151145	0.074	-3.028	-6.525	-5.143	-2.100	4.267	3.508	3.868	44.29	88.18	43.89
25	151158	0.770	-0.472	-4.110	-4.930	-2.746	4.268	3.508	3.868	44.27	88.15	43.88
26	151221	0.965	1.484	-0.707	-2.249	-1.552	4.267	3.508	3.869	44.24	88.09	43.85
27	151241	0.533	1.085	0.499	-0.150	-0.413	4.267	3.508	3.868	44.20	88.02	43.82
28	151300	0.033	-0.469	-1.225	-1.305	-0.594	4.268	3.508	3.867	44.16	88.01	43.85
29	151316	-0.425	-1.866	-4.410	-3.081	-1.076	4.268	3.508	3.869	44.16	88.01	43.85
30	151332	-0.975	-3.423	-5.102	-2.809	-0.653	4.268	3.508	3.869	44.15	88.00	43.85
31	151350	-1.703	-4.153	-4.412	-1.184	0.670	4.269	3.508	3.868	44.12	87.94	43.82
32	151406	-1.493	-3.673	-2.513	0.760	1.317	4.268	3.508	3.869	44.09	87.90	43.81
33	151424	-1.379	-2.260	-0.549	2.090	1.792	4.267	3.508	3.869	44.08	87.88	43.80
34	151442	-0.554	-0.784	1.180	2.762	1.607	4.268	3.508	3.868	44.04	87.80	43.76
35	151500	-0.465	0.093	1.967	2.296	1.385	4.269	3.508	3.869	44.05	87.82	43.77
36	151515	0.078	0.598	1.345	1.569	1.210	4.269	3.508	3.869	44.02	87.75	43.73
	151623	0.000	0.000	0.000	0.000	0.000	4.582	3.872	4.146	48.26	96.16	47.90

Beam B-3 - November 20, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	Shear A/F - B/E	Load Mid	Shear B/E - C/D
	151644	0.000	0.000	0.000	0.000	0.000	4.798	4.136	4.366	50.58	100.80	50.22
1	151748	-1.657	-2.051	-0.994	0.165	-0.120	4.798	4.139	4.367	49.89	99.39	49.50
2	151804	-3.233	-4.944	-2.760	0.062	0.432	4.797	4.139	4.367	49.80	99.22	49.42
3	151821	-3.897	-7.171	-5.651	-1.441	0.347	4.799	4.139	4.368	49.71	99.05	49.34
4	151834	-3.330	-7.835	-7.980	-4.035	-0.682	4.798	4.139	4.367	49.65	98.93	49.28
5	151847	-2.256	-6.638	-9.145	-6.192	-2.506	4.798	4.139	4.367	49.61	98.86	49.25
6	151906	-0.068	-3.564	-7.672	-6.367	-3.603	4.797	4.139	4.367	49.56	98.76	49.20
7	151926	1.186	-0.054	-5.126	-5.756	-4.192	4.797	4.140	4.366	49.46	98.57	49.11
8	151941	1.008	1.466	-1.843	-3.787	-3.344	4.798	4.140	4.367	49.42	98.46	49.04
9	152000	1.279	1.305	0.412	-1.121	-1.510	4.799	4.139	4.367	49.38	98.39	49.01
10	152021	0.941	1.019	2.254	3.621	2.694	4.798	4.140	4.367	49.27	98.23	48.96
11	152038	0.011	1.379	4.355	6.082	3.534	4.799	4.140	4.368	49.22	98.15	48.93
12	152056	-0.100	3.183	6.787	7.533	3.722	4.798	4.141	4.366	49.19	98.08	48.89
13	152113	1.040	5.604	8.555	7.237	3.378	4.798	4.141	4.366	49.16	98.03	48.87
14	152131	2.318	7.302	9.028	5.978	1.942	4.799	4.141	4.368	49.12	97.96	48.84
15	152149	3.156	7.661	7.151	3.955	0.595	4.799	4.142	4.368	49.06	97.85	48.79
16	152208	2.678	6.921	5.462	1.555	-0.513	4.799	4.142	4.367	49.07	97.86	48.79
17	152222	2.795	5.319	2.930	0.053	-1.041	4.799	4.142	4.366	49.03	97.78	48.75
18	152239	1.510	2.153	1.050	-0.042	-0.503	4.799	4.142	4.366	48.99	97.71	48.72
19	152329	-1.648	-1.594	-0.285	0.684	1.257	4.798	4.142	4.367	48.99	97.58	48.59
20	152351	-2.942	-4.194	-1.885	1.021	2.111	4.796	4.142	4.369	48.96	97.54	48.58
21	152409	-3.646	-7.352	-5.050	-0.440	1.741	4.799	4.142	4.367	48.90	97.42	48.52
22	152431	-3.122	-8.198	-7.740	-2.810	0.666	4.799	4.142	4.367	48.89	97.41	48.52
23	152450	-1.560	-6.706	-9.313	-5.356	-1.282	4.798	4.142	4.367	48.83	97.29	48.46
24	152512	0.370	-3.352	-8.046	-6.446	-2.701	4.800	4.142	4.366	48.84	97.31	48.47
25	152526	1.172	-0.443	-5.318	-6.681	-4.185	4.798	4.142	4.370	48.79	97.23	48.44
26	152543	0.839	1.413	-1.668	-4.206	-3.886	4.798	4.142	4.366	48.76	97.15	48.39
27	152556	1.073	1.358	0.418	-0.794	-1.558	4.799	4.142	4.366	48.72	97.09	48.37
28	153208	0.305	-0.031	-1.272	-1.920	-1.293	4.798	4.144	4.371	48.31	96.32	48.01
29	153227	0.303	-1.105	-5.005	-4.564	-2.215	4.798	4.144	4.367	48.28	96.28	48.00
30	153243	-0.329	-3.356	-6.638	-5.164	-2.117	4.798	4.144	4.369	48.28	96.29	48.01
31	153301	-1.627	-5.198	-7.402	-4.001	-0.752	4.799	4.144	4.368	48.24	96.21	47.97
32	153318	-2.305	-6.493	-6.480	-2.064	0.324	4.798	4.144	4.369	48.24	96.20	47.96
33	153336	-2.792	-6.147	-4.892	-0.183	1.438	4.796	4.144	4.369	48.22	96.18	47.96
34	153359	-2.456	-4.817	-1.991	1.694	1.797	4.798	4.144	4.369	48.20	96.12	47.92
35	153420	-1.611	-2.272	0.417	2.435	1.986	4.798	4.144	4.370	48.21	96.15	47.94
36	153439	-0.430	0.005	1.237	2.105	1.446	4.799	4.144	4.369	48.18	96.09	47.91
	153834	0.000	0.000	0.000	0.000	0.000	5.223	4.618	4.861	53.14	105.95	52.81

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	153902	0.000	0.000	0.000	0.000	0.000	5.417	4.877	5.158	55.21	110.09	54.88
1	154010	-2.378	-2.408	-0.762	0.525	-0.042	5.419	4.879	5.162	54.57	108.77	54.20
2	154025	-4.328	-6.279	-2.750	0.604	0.785	5.417	4.879	5.162	54.48	108.59	54.11
3	154043	-5.040	-9.075	-6.408	-1.135	0.753	5.417	4.879	5.162	54.40	108.46	54.06
4	154100	-3.998	-9.622	-9.397	-4.302	-0.355	5.418	4.879	5.160	54.32	108.29	53.97
5	154118	-2.482	-8.068	-10.730	-6.567	-2.166	5.417	4.879	5.162	54.25	108.14	53.89
6	154154	-0.077	-4.089	-9.548	-8.469	-4.308	5.418	4.879	5.162	54.12	107.90	53.78
7	154209	1.430	-0.001	-6.160	-7.526	-5.453	5.418	4.879	5.160	54.08	107.83	53.75
8	154228	1.594	1.959	-2.125	-4.797	-4.672	5.417	4.879	5.162	53.99	107.67	53.68
9	154242	1.282	1.576	0.579	-1.473	-2.200	5.417	4.879	5.162	53.96	107.60	53.64
10	154302	0.669	0.746	2.213	4.029	3.633	5.417	4.879	5.162	53.90	107.52	53.62
11	154319	-0.587	0.793	4.654	7.423	4.767	5.417	4.879	5.162	53.86	107.44	53.58
12	154335	-0.451	2.891	7.705	9.268	4.864	5.417	4.879	5.162	53.81	107.35	53.54
13	154353	0.961	6.107	10.289	9.250	4.114	5.418	4.879	5.162	53.78	107.29	53.51
14	154408	2.387	8.491	11.019	7.188	2.169	5.417	4.879	5.162	53.73	107.20	53.47
15	154426	3.871	9.515	8.738	4.421	0.395	5.417	4.879	5.162	53.71	107.17	53.46
16	154440	3.831	8.974	6.679	1.933	-0.508	5.417	4.879	5.164	53.68	107.12	53.44
17	154456	3.675	6.626	3.417	-0.386	-1.448	5.417	4.880	5.162	53.64	107.04	53.40
18	154514	2.250	2.675	1.029	0.091	-0.553	5.417	4.879	5.164	53.62	107.00	53.38
19	154544	-2.422	-2.073	-0.021	1.148	1.487	5.417	4.880	5.162	53.64	106.90	53.26
20	154559	-4.341	-5.674	-2.115	1.433	2.491	5.417	4.880	5.162	53.59	106.82	53.23
21	154615	-4.919	-9.507	-5.938	-0.388	2.225	5.417	4.880	5.164	53.55	106.75	53.20
22	154636	-3.794	-9.809	-9.100	-3.206	1.101	5.417	4.880	5.162	53.54	106.72	53.18
23	154658	-1.995	-7.964	-11.362	-6.738	-1.349	5.416	4.880	5.160	53.51	106.68	53.17
24	154715	0.393	-4.198	-9.948	-8.885	-3.871	5.417	4.880	5.165	53.46	106.59	53.13
25	154729	1.328	-0.405	-6.364	-8.739	-5.732	5.417	4.880	5.162	53.44	106.55	53.11
26	154748	1.107	1.761	-1.961	-5.435	-5.686	5.417	4.880	5.162	53.36	106.40	53.04
27	154806	1.099	1.556	0.566	-1.308	-2.736	5.417	4.880	5.162	53.33	106.35	53.02
28	154822	0.392	0.287	-1.277	-2.299	-1.800	5.418	4.880	5.164	53.30	106.33	53.03
29	154839	0.608	-0.622	-5.450	-5.669	-3.174	5.417	4.880	5.164	53.27	106.28	53.01
30	154855	-0.012	-3.304	-7.923	-6.808	-3.138	5.417	4.880	5.162	53.25	106.25	53.00
31	154913	-1.486	-6.440	-9.228	-5.748	-1.551	5.417	4.881	5.165	53.21	106.16	52.95
32	154930	-2.744	-8.206	-8.749	-3.617	-0.253	5.417	4.880	5.165	53.21	106.16	52.95
33	154944	-3.958	-8.580	-7.115	-1.162	1.540	5.417	4.881	5.165	53.20	106.15	52.95
34	155001	-3.861	-7.215	-3.533	1.285	2.005	5.418	4.880	5.164	53.17	106.09	52.92
35	155020	-3.034	-3.993	-0.153	2.444	1.978	5.418	4.880	5.164	53.16	106.08	52.92
36	155038	-1.234	-0.653	1.149	2.166	1.583	5.417	4.880	5.164	53.14	106.03	52.89
	155136	-0.035	-0.024	-0.028	0.027	0.041	5.596	5.144	5.306	55.80	111.28	55.48
	155152	-0.029	-0.028	-0.026	0.098	0.036	5.862	5.374	5.433	57.87	115.43	57.56
	155215	-0.053	-0.085	-0.039	0.084	0.048	6.036	5.668	5.745	59.83	119.37	59.54

Beam B-3 - November 20, 1991

											Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/F - B/E	Mid	B/E - C/D	A/F - B/E	Mid	B/E - C/D
	155224	-0.099	-0.078	-0.039	0.083	0.086	6.116	5.761	5.800	60.30	120.34	60.04
1	155527	-3.950	-3.114	-0.491	0.762	0.130	6.116	5.762	5.802	58.52	116.83	58.31
2	155545	-6.359	-8.295	-2.962	0.968	1.126	6.116	5.762	5.802	58.41	116.62	58.21
3	155608	-6.773	-11.730	-7.679	-1.154	1.202	6.116	5.762	5.801	58.32	116.44	58.12
4	155631	-5.215	-12.284	-11.458	-4.952	0.003	6.115	5.762	5.800	58.24	116.28	58.04
5	155654	-2.910	-10.049	-13.678	-8.904	-2.634	6.116	5.762	5.805	58.15	116.08	57.93
6	155719	0.053	-4.958	-11.757	-10.660	-5.095	6.116	5.762	5.803	58.06	115.94	57.88
7	155736	1.858	0.224	-7.308	-9.946	-6.877	6.116	5.762	5.802	57.99	115.80	57.81
8	155756	1.803	2.377	-2.559	-6.486	-6.719	6.115	5.762	5.803	57.96	115.74	57.78
9	155834	1.649	1.922	0.653	-2.030	-3.837	6.116	5.762	5.802	57.85	115.53	57.68
10	155854	0.668	0.311	1.946	4.503	4.295	6.115	5.762	5.805	57.77	115.40	57.63
11	155916	-0.925	0.110	4.513	8.612	5.778	6.116	5.762	5.805	57.74	115.34	57.60
12	155937	-0.957	2.416	8.541	10.930	5.774	6.116	5.762	5.803	57.69	115.25	57.56
13	155953	0.458	6.362	11.996	10.783	4.685	6.116	5.762	5.802	57.66	115.19	57.53
14	160009	2.473	9.817	13.118	8.677	2.219	6.115	5.762	5.804	57.63	115.14	57.51
15	160028	4.419	11.263	10.255	4.731	0.130	6.116	5.762	5.805	57.59	115.08	57.49
16	160051	4.628	10.730	7.355	1.388	-1.267	6.116	5.762	5.805	57.55	114.97	57.42
17	160110	5.052	8.226	3.622	-0.816	-1.686	6.117	5.762	5.803	57.53	114.96	57.43
18	160133	3.003	2.961	0.815	-0.528	-0.591	6.116	5.762	5.803	57.48	114.85	57.37
19	160204	-3.295	-2.337	0.393	1.560	1.755	6.116	5.762	5.804	57.49	114.76	57.27
20	160220	-6.070	-7.252	-2.255	1.765	2.777	6.117	5.762	5.802	57.46	114.70	57.24
21	160237	-6.429	-12.011	-6.764	-0.369	2.495	6.117	5.762	5.805	57.41	114.61	57.20
22	160255	-4.566	-12.310	-11.199	-4.024	1.105	6.116	5.762	5.803	57.37	114.54	57.17
23	160316	-1.982	-9.358	-13.724	-8.205	-1.477	6.116	5.762	5.805	57.32	114.43	57.11
24	160333	0.532	-4.407	-11.787	-11.022	-4.582	6.117	5.762	5.806	57.31	114.42	57.11
25	160409	1.862	-0.205	-7.355	-10.764	-7.373	6.116	5.762	5.803	57.25	114.31	57.06
26	160430	1.612	2.151	-2.306	-6.711	-7.779	6.116	5.762	5.803	57.20	114.22	57.02
27	160446	0.717	1.633	0.632	-1.957	-4.365	6.116	5.762	5.805	57.17	114.16	56.99
28	160507	0.433	0.518	-1.345	-2.961	-2.718	6.117	5.762	5.802	57.11	114.10	56.99
29	160525	1.029	-0.212	-6.033	-7.109	-4.458	6.116	5.762	5.802	57.08	114.03	56.95
30	160542	0.205	-3.498	-9.174	-8.512	-4.259	6.115	5.762	5.804	57.04	113.97	56.93
31	160601	-1.653	-7.235	-11.281	-7.654	-2.314	6.116	5.762	5.805	57.04	113.96	56.92
32	160619	-3.579	-10.098	-11.077	-5.097	-0.354	6.116	5.763	5.805	57.02	113.92	56.90
33	160638	-5.371	-11.082	-9.166	-1.952	1.514	6.116	5.763	5.802	56.97	113.83	56.86
34	160655	-6.084	-9.688	-4.665	1.072	2.409	6.116	5.763	5.803	56.96	113.83	56.87
35	160717	-4.911	-5.546	-0.488	2.669	2.149	6.115	5.763	5.805	56.93	113.77	56.84
36	160737	-2.343	-1.308	1.224	2.161	1.760	6.116	5.763	5.805	56.90	113.72	56.82
	160826	-0.002	-0.017	0.075	0.072	0.033	6.250	5.911	5.879	58.42	116.69	58.27
	160841	0.019	-0.012	0.064	0.066	0.041	6.465	6.180	6.163	60.71	121.28	60.57
	160952	-0.022	0.025	0.007	0.070	0.015	6.938	6.647	6.478	62.64	125.54	62.90
	161011	-0.004	0.017	0.019	0.034	0.036	9.538	7.497	6.239	21.08	42.71	21.63
	161259	-0.011	-0.011	0.052	0.060	0.088	1.943	0.438	1.172	0.03	0.09	0.06

Beam C-1 - December 16, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
	92529	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.03	0.01	-0.02
A	92704	-0.579	-0.628	-0.453	-0.100	0.062	0.164	0.133	0.206	1.61	3.23	1.62
B	92717	-0.491	-0.624	-0.743	-0.321	0.281	0.154	0.133	0.206	1.59	3.19	1.60
C	92732	0.382	0.162	-0.324	-0.336	-0.026	0.137	0.133	0.206	1.62	3.25	1.63
D	92749	0.313	1.080	1.115	0.586	0.163	0.137	0.133	0.206	1.63	3.28	1.65
E	92803	0.524	1.337	1.943	1.386	0.752	0.136	0.133	0.207	1.63	3.26	1.63
F	92820	0.555	0.920	1.025	0.673	0.653	0.147	0.133	0.206	1.64	3.28	1.64
G	92837	-0.060	-0.041	0.031	-0.135	-0.101	0.136	0.133	0.203	1.70	3.34	1.64
H	92902	-0.070	0.062	0.057	0.210	0.491	0.136	0.133	0.203	1.70	3.34	1.64
I	92918	-0.029	0.006	0.053	0.253	0.394	0.146	0.133	0.203	1.70	3.35	1.65
J	92939	0.052	0.017	0.298	0.499	0.776	0.129	0.133	0.203	1.68	3.31	1.63
K	92955	-0.117	-0.257	-0.065	0.098	0.157	0.128	0.133	0.204	1.69	3.33	1.64
L	93014	-0.373	-0.580	-0.611	-0.351	-0.300	0.136	0.133	0.203	1.67	3.28	1.61
M	93035	-0.545	-0.593	-0.526	-0.533	0.049	0.146	0.133	0.203	1.72	3.35	1.63
N	93104	0.894	1.430	1.347	1.101	1.382	0.146	0.133	0.203	1.75	3.36	1.61
O	93124	1.290	2.210	2.449	1.699	1.584	0.129	0.133	0.203	1.71	3.30	1.59
P	93146	1.492	2.642	2.909	2.116	1.648	0.129	0.133	0.203	1.71	3.32	1.61
Q	93209	1.760	2.535	3.191	2.555	1.842	0.136	0.133	0.203	1.68	3.25	1.57
R	93230	1.894	2.684	3.160	2.654	1.659	0.146	0.133	0.203	1.69	3.28	1.59
S	93249	1.385	1.959	2.421	2.097	1.491	0.129	0.133	0.203	1.67	3.25	1.58
T	93317	1.180	1.298	1.653	1.746	1.237	0.146	0.133	0.203	1.61	3.21	1.60
U	93336	0.837	1.242	1.804	2.082	1.496	0.137	0.133	0.203	1.60	3.20	1.60
V	93356	0.501	1.185	1.878	2.131	1.265	0.129	0.133	0.203	1.60	3.21	1.61
W	93410	0.643	1.349	1.808	1.841	1.244	0.146	0.133	0.203	1.56	3.13	1.57
X	93424	0.561	1.011	1.509	1.413	0.866	0.139	0.133	0.203	1.57	3.14	1.57
	93440	0.251	0.635	1.393	1.617	1.030	0.129	0.133	0.203	1.58	3.17	1.59
	93728						0.108	0.120	0.079	2.48	4.91	2.43
	93745						0.183	0.281	0.228	4.81	9.63	4.82
	93806						0.321	0.467	0.276	7.16	14.33	7.17
	93825	0.039	-0.080	0.009	0.024	-0.016	0.493	0.689	0.602	9.82	19.64	9.82
A	93909	-0.583	-0.983	-0.621	-0.074	0.026	0.514	0.699	0.612	9.71	19.46	9.75
B	93921	-0.514	-0.985	-1.193	-0.740	0.024	0.493	0.699	0.609	9.68	19.40	9.72
C	93937	0.495	0.245	-0.509	-0.631	-0.262	0.487	0.699	0.612	9.68	19.39	9.71
D	93953	0.649	1.568	1.547	0.712	0.176	0.493	0.699	0.609	9.64	19.31	9.67
E	94011	0.808	1.525	2.466	2.047	0.795	0.514	0.699	0.612	9.61	19.25	9.64
F	94027	0.507	0.870	1.225	1.366	0.930	0.493	0.699	0.612	9.57	19.16	9.59
G	94049	-0.132	-0.229	-0.301	-0.227	-0.311	0.493	0.699	0.609	9.60	19.16	9.56
H	94102	-0.260	-0.410	-0.001	0.383	0.122	0.531	0.699	0.612	9.60	19.15	9.55
I	94117	-0.127	-0.384	0.047	0.178	0.164	0.496	0.699	0.609	9.63	19.20	9.57
J	94140	-0.084	-0.444	0.052	0.284	0.099	0.493	0.699	0.609	9.58	19.10	9.52
K	94203	-0.323	-0.524	-0.492	0.425	-0.326	0.514	0.699	0.612	9.60	19.13	9.53
L	94219	-0.582	-0.849	-0.551	-0.472	0.086	0.493	0.699	0.609	9.58	19.08	9.50
M	94247	0.970	1.356	1.486	1.358	1.233	0.493	0.699	0.609	9.55	19.03	9.48
N	94306	1.397	2.239	2.823	2.039	1.584	0.493	0.699	0.609	9.53	19.00	9.47

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
O	94325	1.661	3.509	3.305	2.575	2.023	0.493	0.699	0.609	9.54	19.01	9.47
P	94341	1.765	2.842	3.458	2.555	2.299	0.520	0.699	0.609	9.53	19.01	9.48
Q	94357	1.694	2.723	3.127	2.843	2.036	0.504	0.699	0.612	9.51	18.98	9.47
R	94414	1.257	1.946	2.383	2.180	1.829	0.504	0.699	0.612	9.54	19.03	9.49
S	94432	1.017	1.053	1.400	1.553	1.388	0.513	0.699	0.610	9.49	19.00	9.51
T	94447	0.521	0.926	1.702	1.739	1.724	0.496	0.699	0.609	9.45	18.93	9.48
U	94503	0.401	0.964	1.507	1.853	1.557	0.507	0.699	0.609	9.46	18.97	9.51
V	94519	0.628	1.389	1.679	1.717	1.587	0.514	0.699	0.609	9.44	18.92	9.48
W	94534	0.609	0.920	1.354	1.299	0.951	0.511	0.699	0.612	9.47	19.00	9.53
X	94553	0.360	0.668	1.212	1.613	1.120	0.493	0.699	0.609	9.46	18.96	9.50
	95342						0.232	0.475	0.596	9.88	19.58	9.70
	95356						0.360	0.682	0.812	12.34	24.45	12.11
	95412						0.575	0.896	0.939	14.99	29.71	14.72
	95429						0.751	1.079	1.094	17.19	34.09	16.90
	95446	0.000	0.000	0.000	0.000	0.000	0.926	1.275	1.276	19.71	39.09	19.38
A	95644	-0.694	-1.220	-0.922	-0.199	0.094	0.953	1.311	1.284	19.48	38.67	19.19
B	95659	-0.666	-1.388	-1.901	-1.281	-0.202	0.953	1.311	1.284	19.49	38.69	19.20
C	95714	0.929	0.632	-0.796	-1.275	-0.703	0.953	1.311	1.280	19.43	38.57	19.14
D	95730	0.985	2.389	2.110	0.557	-0.314	0.943	1.311	1.283	19.41	38.52	19.11
E	95744	0.896	2.379	3.224	2.062	1.140	0.960	1.311	1.284	19.32	38.39	19.07
F	95801	0.555	1.059	1.595	1.635	1.147	0.946	1.311	1.284	19.25	38.22	18.97
G	95818	-0.181	-0.310	-0.338	-0.342	-0.220	0.936	1.311	1.283	19.23	38.09	18.86
H	95837	-0.441	-0.332	-0.370	-0.071	0.255	0.943	1.311	1.283	19.19	37.99	18.80
I	95854	-0.197	-0.213	0.010	0.390	0.524	0.954	1.311	1.283	19.13	37.88	18.75
J	95911	-0.071	-0.055	0.358	0.498	0.421	0.963	1.311	1.284	19.09	37.80	18.71
K	95928	-0.213	-0.238	-0.201	0.487	-0.236	0.953	1.311	1.284	19.08	37.77	18.69
L	95942	-0.506	-0.631	-0.303	-0.369	0.021	0.933	1.311	1.283	19.06	37.72	18.66
M	100012	1.052	1.886	1.449	0.991	1.317	0.953	1.311	1.284	18.99	37.58	18.59
N	100026	1.649	2.950	3.163	1.901	1.540	0.956	1.312	1.284	18.88	37.38	18.50
O	100046	1.815	4.380	4.053	3.213	1.988	0.953	1.313	1.284	18.87	37.36	18.49
P	100100	2.127	3.538	4.287	3.546	2.421	0.953	1.314	1.284	18.85	37.34	18.49
Q	100117	1.804	3.103	3.753	3.528	2.061	0.960	1.314	1.283	18.78	37.19	18.41
R	100136	1.011	1.809	2.591	2.488	1.741	0.954	1.315	1.283	18.74	37.11	18.37
S	100200	0.842	1.084	1.133	1.153	1.129	0.954	1.316	1.287	18.69	37.10	18.41
T	100223	0.327	0.938	1.591	1.935	1.339	0.958	1.316	1.286	18.66	37.03	18.37
U	100239	0.290	0.875	1.800	2.223	1.420	0.933	1.317	1.287	18.61	36.95	18.34
V	100300	0.560	1.443	2.148	2.051	1.363	0.936	1.317	1.288	18.55	36.83	18.28
W	100320	0.587	1.275	1.828	1.193	1.190	0.946	1.317	1.287	18.58	36.89	18.31
X	100342	0.414	1.060	1.216	1.363	1.239	0.954	1.318	1.287	18.50	36.74	18.24
	100449						1.097	1.501	1.383	22.00	43.64	21.64
	100508						1.290	1.689	1.520	24.29	48.21	23.92

Beam C-1 - December 16, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
	100522						1.438	1.866	1.689	26.64	52.87	26.23
	100541	0.065	0.057	0.047	0.069	0.018	1.602	2.072	1.837	29.01	57.56	28.55
A	100628	-1.003	-1.976	-1.568	-0.361	0.131	1.640	2.091	1.844	28.72	57.03	28.31
B	100647	-0.766	-2.123	-3.038	-2.081	-0.492	1.612	2.091	1.848	28.63	56.85	28.22
C	100704	1.224	0.777	-1.524	-2.405	-1.381	1.630	2.091	1.844	28.62	56.82	28.20
D	100722	1.483	3.499	2.869	0.420	-0.987	1.620	2.091	1.844	28.56	56.69	28.13
E	100741	1.083	2.890	4.135	3.138	1.363	1.613	2.091	1.844	28.49	56.55	28.06
F	100756	0.543	1.259	2.129	2.321	1.738	1.623	2.091	1.847	28.50	56.57	28.07
G	100818	-0.260	-0.568	-0.594	-0.587	-0.362	1.620	2.091	1.847	28.45	56.42	27.97
H	100836	-0.738	-0.814	-0.797	-0.270	0.175	1.613	2.091	1.844	28.40	56.31	27.91
I	100854	-0.300	-0.385	-0.019	0.675	0.666	1.613	2.091	1.844	28.38	56.26	27.88
J	100908	-0.116	0.206	0.875	0.967	0.611	1.637	2.091	1.844	28.36	56.21	27.85
K	100925	-0.133	0.244	0.358	0.336	-0.110	1.620	2.091	1.847	28.33	56.15	27.82
L	100941	-0.503	-0.488	-0.183	-0.363	-0.120	1.613	2.091	1.847	28.36	56.19	27.83
M	101006	1.262	2.190	1.638	0.677	0.938	1.630	2.091	1.847	28.29	56.07	27.78
N	101026	2.015	3.585	3.973	2.230	1.079	1.613	2.092	1.847	28.27	56.03	27.76
O	101043	2.286	5.385	5.186	4.128	2.240	1.620	2.091	1.847	28.22	55.94	27.72
P	101059	2.316	4.614	5.702	4.517	2.682	1.620	2.091	1.844	28.17	55.86	27.69
Q	101119	1.711	3.754	4.724	3.984	2.528	1.620	2.092	1.847	28.17	55.86	27.69
R	101134	1.032	2.184	3.083	3.101	2.557	1.623	2.091	1.848	28.16	55.81	27.65
S	101154	0.882	0.444	0.530	1.026	1.320	1.629	2.092	1.849	28.06	55.69	27.63
T	101211	-0.051	-0.021	1.009	1.886	2.019	1.613	2.091	1.844	28.07	55.73	27.66
U	101228	-0.061	1.006	2.311	2.111	1.804	1.623	2.091	1.845	28.08	55.75	27.67
V	101251	0.700	2.280	3.492	2.619	1.605	1.640	2.091	1.844	28.04	55.67	27.63
W	101317	1.146	2.529	3.070	1.969	1.297	1.620	2.091	1.844	28.03	55.65	27.62
X	101335	0.727	1.312	1.644	1.785	1.780	1.640	2.091	1.847	27.98	55.58	27.60
	101429						1.867	2.336	2.016	31.46	62.40	30.94
	101447	0.000	0.000	0.000	0.000	0.000	2.053	2.567	2.233	34.33	68.12	33.79
A	101527	-1.415	-2.837	-1.882	-0.198	0.230	2.107	2.650	2.291	34.93	69.38	34.45
B	101542	-1.023	-3.038	-3.900	-2.669	-0.469	2.114	2.650	2.291	34.89	69.30	34.41
C	101603	1.625	0.941	-1.849	-3.076	-1.922	2.128	2.650	2.288	34.78	69.09	34.31
D	101621	1.789	3.919	3.337	0.274	-1.655	2.128	2.650	2.288	34.71	68.93	34.22
E	101641	1.033	3.219	4.771	3.724	1.601	2.114	2.649	2.291	34.66	68.86	34.20
F	101703	0.159	1.238	2.454	3.125	2.476	2.135	2.650	2.291	34.56	68.67	34.11
G	101727	-0.458	-1.159	-0.954	-0.605	-0.536	2.134	2.650	2.289	34.60	68.64	34.04
H	101748	-1.178	-1.735	-1.267	-0.174	0.252	2.125	2.650	2.288	34.57	68.58	34.01
I	101806	-0.771	-1.039	0.068	1.281	1.236	2.107	2.650	2.288	34.49	68.42	33.93
J	101829	-0.198	0.265	1.634	1.973	1.289	2.134	2.650	2.289	34.46	68.36	33.90
K	101850	0.144	0.874	1.380	1.411	0.520	2.135	2.650	2.291	34.47	68.36	33.89
L	101912	-0.524	-0.583	0.201	-0.041	-0.283	2.125	2.650	2.288	34.37	68.18	33.81
M	101946	1.532	2.279	1.613	0.731	1.362	2.125	2.650	2.291	34.32	68.08	33.76
N	102004	2.372	4.376	4.834	1.777	0.753	2.107	2.650	2.291	34.30	68.05	33.75
O	102024	2.536	6.372	6.308	4.428	2.074	2.107	2.650	2.291	34.29	68.02	33.73
P	102046	2.481	5.463	6.640	5.641	3.463	2.118	2.650	2.290	34.26	67.94	33.68

Beam C-1 - December 16, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
Q	102106	1.621	4.050	5.429	5.253	3.573	2.118	2.650	2.287	34.25	67.94	33.69
R	102124	0.646	1.911	3.215	3.122	2.905	2.114	2.650	2.288	34.21	67.88	33.67
S	102146	0.466	-0.187	0.029	0.253	0.772	2.117	2.650	2.288	34.12	67.78	33.66
T	102205	-0.695	-1.182	0.481	1.628	1.976	2.114	2.650	2.291	34.12	67.79	33.67
U	102225	-0.674	0.298	2.686	3.694	2.928	2.117	2.650	2.288	34.09	67.72	33.63
V	102246	-0.001	2.766	4.679	4.056	2.438	2.114	2.650	2.288	34.04	67.63	33.59
W	102311	1.429	3.732	3.947	2.450	1.221	2.125	2.650	2.288	34.06	67.70	33.64
X	102331	0.957	1.855	2.133	1.436	0.717	2.135	2.650	2.288	34.02	67.61	33.59
	102430						2.252	2.811	2.412	36.39	72.22	35.83
	102453	0.000	0.000	0.000	0.000	0.000	2.454	3.031	2.514	39.23	77.90	38.67
A	102527	-1.618	-3.130	-2.266	-0.458	0.289	2.444	3.038	2.518	38.95	77.40	38.45
B	102544	-0.912	-3.443	-4.726	-3.141	-0.696	2.461	3.038	2.521	38.87	77.24	38.37
C	102604	2.060	1.297	-2.516	-3.919	-2.299	2.454	3.038	2.522	38.78	77.05	38.27
D	102624	2.073	4.525	3.287	-0.336	-2.434	2.448	3.038	2.518	38.69	76.89	38.20
E	102643	1.180	3.648	5.416	3.539	1.019	2.448	3.038	2.518	38.67	76.84	38.17
F	102706	0.393	1.561	2.899	3.015	2.226	2.444	3.038	2.518	38.62	76.76	38.14
G	102726	-0.655	-1.313	-1.252	-0.866	-0.616	2.454	3.038	2.518	38.55	76.54	37.99
H	102744	-1.550	-2.217	-1.580	-0.221	0.323	2.457	3.038	2.519	38.52	76.48	37.96
I	102803	-0.985	-1.027	0.368	1.923	1.615	2.457	3.038	2.519	38.49	76.39	37.90
J	102822	-0.132	1.376	2.561	2.292	1.271	2.448	3.039	2.521	38.48	76.38	37.90
K	102844	0.478	1.436	1.899	1.876	0.056	2.444	3.039	2.521	38.41	76.24	37.83
L	102905	-0.223	-0.102	0.403	-0.098	-0.546	2.444	3.039	2.518	38.44	76.28	37.84
M	102937	1.678	2.662	1.630	0.507	0.846	2.464	3.039	2.519	38.35	76.13	37.78
N	103003	2.704	5.209	5.133	1.606	0.385	2.444	3.039	2.518	38.30	76.02	37.72
O	103032	2.934	7.392	7.059	4.635	2.153	2.464	3.039	2.518	38.29	76.03	37.74
P	103053	2.610	6.120	7.345	6.150	3.626	2.444	3.039	2.518	38.25	75.93	37.68
Q	103111	1.683	4.229	5.753	5.830	3.872	2.469	3.039	2.520	38.21	75.85	37.64
R	103135	0.621	2.185	3.314	3.538	3.148	2.465	3.039	2.518	38.20	75.84	37.64
S	103200	0.590	-0.490	-1.065	-0.097	0.856	2.471	3.039	2.518	38.11	75.75	37.64
T	103222	-0.986	-1.899	-0.651	1.213	1.976	2.471	3.039	2.518	38.13	75.79	37.66
U	103250	-1.131	-0.171	2.234	4.089	3.414	2.454	3.039	2.519	38.06	75.65	37.59
V	103315	0.305	3.011	5.358	4.568	2.620	2.465	3.039	2.518	38.07	75.69	37.62
W	103338	1.887	4.481	4.633	2.669	1.468	2.444	3.039	2.518	38.00	75.55	37.55
X	103401	1.267	2.327	2.368	1.243	0.570	2.447	3.039	2.519	37.92	75.43	37.51
	103505						2.657	3.342	2.788	42.04	83.50	41.46

Beam C-1 - December 16, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
	103529	0.000	0.000	0.000	0.000	0.000	2.883	3.630	3.000	44.98	89.34	44.36
A	103623	-2.428	-4.653	-3.066	-0.267	0.673	2.877	3.631	3.000	44.42	88.31	43.89
B	103641	-1.066	-4.451	-6.176	-3.703	-0.230	2.884	3.632	3.002	44.32	88.10	43.78
C	103658	2.244	1.282	-3.970	-5.462	-2.865	2.877	3.632	3.003	44.24	87.94	43.70
D	103718	2.242	4.810	2.785	-1.500	-3.430	2.883	3.632	3.003	44.15	87.75	43.60
E	103736	1.154	3.901	5.714	3.522	0.619	2.883	3.632	3.003	44.02	87.49	43.47
F	103756	0.231	1.537	3.052	3.421	2.837	2.897	3.632	3.004	43.99	87.42	43.43
G	103816	-0.821	-1.804	-1.742	-0.927	-0.328	2.901	3.632	3.003	43.96	87.31	43.35
H	103837	-2.100	-2.755	-1.682	0.614	1.478	2.883	3.632	3.003	43.87	87.12	43.25
I	103855	-1.404	-0.759	1.756	3.174	2.142	2.904	3.632	3.004	43.80	86.98	43.18
J	103914	0.358	2.188	4.503	3.922	2.048	2.897	3.632	3.003	43.77	86.92	43.15
K	103932	1.173	2.930	3.194	1.389	-0.435	2.894	3.632	3.003	43.74	86.84	43.10
L	103955	-0.013	0.427	0.405	-0.368	-0.609	2.877	3.632	3.003	43.71	86.79	43.08
M	104032	1.924	3.340	1.618	-0.267	0.660	2.883	3.632	3.003	43.63	86.64	43.01
N	104053	3.113	6.501	5.715	1.573	0.507	2.877	3.632	3.003	43.58	86.54	42.96
O	104113	3.193	8.358	8.035	5.140	1.998	2.894	3.632	3.003	43.54	86.46	42.92
P	104133	2.680	6.711	8.230	7.068	4.043	2.880	3.632	3.004	43.53	86.44	42.91
Q	104150	1.312	4.327	6.206	6.667	4.567	2.883	3.632	3.003	43.50	86.36	42.86
R	104208	0.351	1.898	3.238	4.072	3.601	2.883	3.632	3.003	43.41	86.22	42.81
S	104227	0.510	-1.015	-2.298	-1.167	0.509	2.904	3.632	3.004	43.31	86.08	42.77
T	104247	-1.482	-3.268	-2.484	0.313	2.174	2.894	3.632	3.003	43.29	86.04	42.75
U	104306	-2.062	-1.721	1.336	4.392	3.976	2.887	3.632	2.999	43.29	86.06	42.77
V	104323	-0.659	2.498	5.850	5.478	3.020	2.894	3.632	3.003	43.27	86.02	42.75
W	104342	1.909	5.346	5.577	3.126	1.398	2.877	3.632	3.003	43.26	86.00	42.74
X	104400	1.814	3.103	2.595	1.452	0.982	2.883	3.632	3.003	43.26	86.01	42.75
	104534						3.151	3.888	3.219	46.70	92.70	46.00
	104558	0.000	0.000	0.000	0.000	0.000	3.351	4.241	3.458	50.35	99.83	49.48
A	104645	-3.762	-6.136	-3.229	-0.183	0.850	3.378	4.241	3.457	49.31	97.77	48.46
B	104702	-1.638	-6.564	-7.672	-4.216	-0.167	3.371	4.241	3.458	49.17	97.47	48.30
C	104721	2.288	0.107	-6.055	-7.351	-3.661	3.361	4.241	3.461	49.04	97.20	48.16
D	104739	2.452	5.130	2.057	-3.277	-4.963	3.378	4.241	3.461	48.85	96.80	47.95
E	104801	1.395	3.894	5.533	3.055	-0.622	3.351	4.241	3.461	48.74	96.57	47.83
F	104824	0.507	1.532	2.983	3.608	2.882	3.392	4.241	3.458	48.66	96.37	47.71
G	104846	-0.991	-2.208	-1.731	-0.757	0.388	3.371	4.241	3.458	48.57	96.13	47.56
H	104908	-2.397	-2.917	-0.667	2.156	2.611	3.374	4.242	3.459	48.44	95.86	47.42
I	104927	-1.416	0.635	3.577	5.194	3.169	3.361	4.242	3.457	48.41	95.79	47.38
J	104945	1.011	4.154	6.575	4.557	1.601	3.375	4.242	3.460	48.32	95.60	47.28
K	105004	2.004	4.496	4.076	1.624	-0.697	3.392	4.242	3.458	48.30	95.54	47.24
L	105024	0.480	0.918	0.562	-0.756	-1.184	3.378	4.241	3.457	48.21	95.36	47.15
M	105053	2.383	3.593	1.325	-0.354	0.553	3.361	4.242	3.461	48.13	95.21	47.08
N	105109	3.633	7.082	6.104	1.003	-0.357	3.371	4.242	3.458	48.08	95.10	47.02
O	105128	3.425	9.200	8.899	5.472	1.453	3.378	4.242	3.461	48.03	95.00	46.97
P	105147	2.595	7.180	9.280	7.795	4.264	3.351	4.242	3.461	48.02	94.96	46.94
Q	105211	1.277	4.599	7.178	8.066	5.875	3.361	4.242	3.458	47.93	94.80	46.87
R	105229	0.091	1.266	3.596	4.254	4.120	3.361	4.242	3.457	47.92	94.77	46.85
S	105253	0.676	-1.319	-3.376	-2.843	-0.626	3.351	4.242	3.458	47.83	94.65	46.82

Beam C-1 - December 16, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
T	105315	-1.739	-4.714	-4.900	-1.011	2.325	3.378	4.242	3.458	47.77	94.54	46.77
U	105336	-3.277	-4.148	-0.592	3.894	3.925	3.378	4.242	3.458	47.70	94.39	46.69
V	105355	-2.319	0.664	5.937	6.166	3.631	3.361	4.242	3.461	47.70	94.40	46.70
W	105417	1.390	5.974	6.589	3.326	1.210	3.361	4.242	3.461	47.67	94.34	46.67
X	105434	2.371	3.604	2.693	1.560	1.046	3.351	4.242	3.461	47.62	94.23	46.61
	105539						3.735	4.572	3.616	51.80	102.35	50.55
	105606	0.000	0.000	0.000	0.000	0.000	3.976	4.885	3.933	54.38	107.15	52.77
A	105704	-5.791	-8.340	-3.285	0.306	0.966	4.037	4.923	3.943	53.27	104.70	51.43
B	105724	-5.595	-9.668	-9.659	-4.258	0.105	4.013	4.924	3.943	53.03	104.15	51.12
C	105742	1.704	-1.900	-9.603	-9.865	-4.304	4.037	4.924	3.943	52.85	103.76	50.91
D	105804	2.333	3.750	0.123	-5.968	-7.518	4.031	4.924	3.944	52.69	103.39	50.70
E	105822	2.418	5.095	6.011	3.307	-0.434	4.048	4.924	3.943	52.52	103.05	50.53
F	105842	1.743	4.102	4.913	1.689	-2.655	4.037	4.926	3.946	52.42	102.80	50.38
G	105902	0.883	1.840	3.086	3.524	2.459	4.058	4.928	3.946	52.23	102.39	50.16
H	105920	-0.965	-1.733	-1.169	0.348	1.778	4.058	4.929	3.944	52.22	102.30	50.08
I	105937	-2.447	-2.697	0.491	4.338	4.015	4.058	4.929	3.942	52.13	102.09	49.96
J	105956	-1.322	1.571	5.308	7.291	3.706	4.048	4.930	3.942	52.00	101.76	49.76
K	110011	1.729	5.945	8.261	5.313	1.427	4.068	4.936	3.943	51.76	101.14	49.38
L	110027	3.171	6.183	4.823	1.352	-1.276	4.092	4.940	3.942	51.54	100.60	49.06
M	110044	0.901	1.373	0.366	-1.163	-1.221	4.092	4.941	3.943	51.40	100.25	48.85
N	110110	2.916	4.050	1.332	-0.767	0.237	4.092	4.942	3.943	51.23	99.83	48.60
O	110125	4.080	8.091	6.280	1.149	-0.525	4.092	4.944	3.943	51.11	99.56	48.45
P	110142	3.551	9.143	9.880	5.382	0.757	4.120	4.947	3.946	50.99	99.29	48.30
Q	110200	2.497	7.401	10.020	8.511	4.320	4.144	4.951	3.944	50.78	98.80	48.02
R	110219	0.848	4.125	7.250	8.574	6.187	4.168	4.955	3.942	50.66	98.51	47.85
S	110234	-0.099	1.045	3.503	4.445	4.141	4.168	4.956	3.946	50.55	98.27	47.72
T	110310	-0.032	-0.036	-0.050	0.043	-0.056	6.047	5.601	3.720	27.73	53.88	26.15

Beam C-2 - December 16, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
	140936	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.91	3.29	1.01
A	140957	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.89	2.45	1.04
B	141015	0.234	0.674	0.693	0.530	0.110	-0.012	0.000	0.000	0.91	4.19	1.07
C	141032	-0.297	0.116	0.963	0.514	0.433	-0.001	0.000	-0.003	0.89	1.32	1.06
D	141048	-0.333	-0.078	0.350	0.545	0.459	-0.001	0.000	0.000	0.88	0.49	1.03
E	141104	-0.679	-0.518	-0.862	0.193	0.010	0.005	0.000	0.000	0.87	-0.05	1.01
F	141120	-0.684	-1.310	-1.258	-0.828	-0.486	-0.022	0.000	0.000	0.88	3.66	1.04
G	141140	-0.977	-1.569	-1.202	-0.657	-0.215	0.005	0.000	0.000	0.90	3.81	0.97
H	141157	-0.213	-0.128	-0.054	0.247	0.270	-0.001	0.000	0.000	0.90	0.48	0.96
I	141213	-0.393	-0.118	0.098	0.249	-0.165	-0.009	0.000	0.000	0.91	3.98	0.97
J	141231	-0.940	-1.268	-0.873	-0.386	0.011	-0.012	0.000	0.000	0.92	3.68	0.98
K	141244	-1.183	-1.637	-1.144	-0.950	-0.407	0.005	0.000	0.000	0.91	3.50	0.96
L	141259	-1.085	-1.504	-1.330	-0.714	-0.037	-0.012	0.000	0.000	0.92	1.06	0.97
M	141322	-1.138	-2.054	-2.556	-2.099	-1.383	-0.018	0.000	-0.003	0.92	2.55	0.96
N	141337	-1.679	-2.691	-3.035	-2.411	-1.466	0.005	0.001	0.000	0.91	2.28	0.95
O	141350	-1.598	-2.636	-2.875	-2.080	-1.213	0.005	0.001	0.000	0.91	4.01	0.95
P	141404	-0.960	-1.397	-1.428	-0.988	-0.815	0.005	0.001	0.000	0.89	-0.19	0.94
Q	141421	-0.030	-0.110	-0.408	-0.332	-0.291	-0.001	0.001	0.000	0.89	4.13	0.94
R	141437	-0.082	-0.443	-0.461	-0.283	-0.110	-0.012	0.000	0.000	0.89	-0.02	0.92
S	141455	-0.141	-0.012	-0.255	0.094	0.144	0.005	0.000	0.000	0.84	0.90	0.98
T	141514	-0.494	-0.404	-0.207	0.011	0.021	-0.012	0.000	0.000	0.82	1.96	0.96
U	141531	-1.124	-1.260	-1.189	-0.687	-0.511	0.005	0.000	0.000	0.83	4.19	0.99
V	141545	-0.719	-0.980	-0.797	-0.754	-0.591	-0.003	0.000	0.000	0.83	-0.78	0.98
W	141600	-0.557	-0.298	-0.349	-0.323	-0.567	-0.003	0.000	0.000	0.83	4.13	0.99
X	141616	0.354	0.186	0.397	0.241	-0.061	-0.001	0.000	0.000	0.81	0.78	0.98
	141658						0.007	0.076	0.000	2.55	8.61	2.75
	141714						0.088	0.251	0.062	4.67	9.46	4.96
	141731						0.307	0.480	0.389	7.38	14.37	7.66
	141750	0.000	0.000	0.000	0.000	0.000	0.574	0.736	0.554	10.59	24.52	10.76
A	141823	2.017	2.094	2.032	1.474	0.967	0.565	0.737	0.558	10.43	22.20	10.63
B	141845	1.468	2.794	2.823	2.137	1.327	0.582	0.739	0.558	10.44	22.90	10.64
C	141911	1.013	2.297	2.591	2.133	1.637	0.576	0.739	0.561	10.32	22.25	10.51
D	141935	0.940	2.053	2.590	2.216	1.526	0.568	0.739	0.561	10.33	24.48	10.52
E	141950	0.540	1.433	1.443	1.816	1.168	0.582	0.739	0.558	10.33	22.35	10.54
F	142011	0.466	0.691	0.775	0.734	0.585	0.584	0.739	0.561	10.24	22.11	10.46
G	142031	0.208	0.297	0.785	0.856	0.969	0.581	0.739	0.561	10.33	19.68	10.43
H	142045	0.716	1.853	2.131	1.823	1.350	0.574	0.739	0.561	10.30	22.54	10.42
I	142101	0.843	1.894	2.189	1.809	0.863	0.582	0.739	0.561	10.25	22.02	10.37
J	142120	0.360	0.793	1.146	0.952	0.838	0.582	0.739	0.561	10.24	21.80	10.34
K	142138	0.044	0.502	0.673	0.561	0.670	0.582	0.739	0.561	10.26	20.77	10.34
L	142154	0.340	0.506	0.724	0.816	0.961	0.593	0.739	0.561	10.26	24.11	10.34
M	142221	-0.017	-0.125	-0.437	-0.533	-0.301	0.582	0.739	0.561	10.25	20.21	10.32
N	142236	-0.372	-0.509	-0.797	-0.738	-0.256	0.573	0.739	0.561	10.24	22.66	10.33
O	142252	-0.300	-0.501	-0.440	-0.403	-0.148	0.548	0.739	0.561	10.23	19.32	10.32

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										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
P	142308	0.230	0.574	0.526	0.414	0.035	0.576	0.739	0.561	10.20	21.19	10.30
Q	142326	1.205	1.690	1.472	1.127	0.651	0.548	0.739	0.561	10.25	21.80	10.32
R	142345	1.032	1.402	1.606	1.178	0.848	0.567	0.739	0.564	10.16	23.44	10.28
S	142404	1.004	1.878	1.956	1.872	1.143	0.559	0.739	0.561	10.16	20.10	10.33
T	142422	0.845	1.694	2.119	1.902	1.118	0.584	0.739	0.561	10.14	21.21	10.33
U	142438	0.218	0.849	1.533	1.445	0.913	0.581	0.739	0.564	10.14	21.55	10.32
V	142453	0.624	1.495	1.961	1.539	0.655	0.576	0.739	0.561	10.11	23.31	10.30
W	142516	0.808	1.830	2.302	1.572	0.752	0.582	0.739	0.561	10.11	24.08	10.31
X	142536	1.713	2.497	2.520	1.723	0.903	0.582	0.739	0.561	10.12	20.41	10.34
	142748						0.665	0.875	0.723	11.97	27.15	11.86
	142808						0.758	1.056	0.912	14.35	31.09	14.28
	142824						0.997	1.275	1.039	16.90	35.02	16.91
	142850	0.000	0.000	0.000	0.000	0.000	1.154	1.504	1.177	19.15	37.93	19.23
A	142923	1.365	2.199	2.277	1.489	0.889	1.163	1.505	1.184	18.90	39.49	19.03
B	142951	1.484	2.852	3.134	2.283	1.217	1.162	1.505	1.184	18.82	37.93	18.93
C	143008	1.021	2.402	2.914	2.337	1.696	1.159	1.505	1.187	18.74	41.62	18.85
D	143022	0.806	2.214	2.851	2.307	1.589	1.153	1.505	1.187	18.70	37.48	18.81
E	143040	0.398	1.229	1.339	1.949	1.167	1.173	1.507	1.187	18.75	36.64	18.84
F	143056	0.383	0.518	0.754	0.765	0.596	1.187	1.507	1.191	18.71	36.05	18.79
G	143116	0.020	0.238	0.889	0.986	0.995	1.180	1.507	1.187	18.73	41.88	18.76
H	143137	0.710	1.961	2.214	2.028	1.459	1.173	1.508	1.194	18.72	37.14	18.73
I	143159	0.869	2.157	2.378	1.903	0.804	1.187	1.507	1.194	18.67	36.36	18.67
J	143217	0.343	0.976	1.214	0.804	0.770	1.187	1.508	1.194	18.64	35.55	18.65
K	143235	0.061	0.611	0.675	0.496	0.558	1.170	1.508	1.194	18.63	39.39	18.62
L	143253	0.411	0.567	0.755	0.719	0.936	1.173	1.508	1.194	18.62	36.33	18.62
M	143331	-0.032	-0.090	-0.383	-0.448	-0.255	1.187	1.508	1.194	18.58	36.54	18.58
N	143348	-0.346	-0.410	-0.553	-0.396	-0.213	1.188	1.507	1.194	18.57	38.89	18.58
O	143406	-0.386	-0.581	-0.548	-0.484	-0.361	1.208	1.507	1.194	18.58	40.24	18.59
P	143427	0.074	0.400	0.493	0.554	-0.133	1.171	1.508	1.194	18.56	39.71	18.52
Q	143443	0.482	1.471	1.363	1.131	0.597	1.180	1.507	1.194	18.54	35.71	18.51
R	143500	1.023	1.125	1.592	1.364	0.799	1.168	1.508	1.194	18.54	39.85	18.51
S	143520	1.088	1.714	1.989	2.065	1.472	1.180	1.508	1.194	18.43	38.23	18.51
T	143537	0.844	1.866	2.573	2.430	1.873	1.170	1.508	1.194	18.45	40.16	18.54
U	143554	0.340	1.537	2.386	2.553	1.765	1.187	1.507	1.194	18.43	41.51	18.52
V	143613	0.548	2.241	3.241	2.602	1.377	1.159	1.507	1.194	18.43	40.34	18.52
W	143633	0.990	2.720	3.187	2.260	0.847	1.180	1.507	1.194	18.36	35.93	18.47
X	143649	1.925	2.598	2.966	2.067	1.027	1.187	1.507	1.194	18.42	40.53	18.50
	143742						1.297	1.683	1.431	20.98	44.07	21.07
	143800						1.571	1.918	1.621	23.55	52.28	23.57
	143812						1.736	2.120	1.751	26.09	55.89	26.15

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
	143831	0.000	0.000	0.000	0.000	0.000	1.951	2.376	1.927	29.17	63.33	29.26
A	143906	1.697	2.617	2.480	1.349	0.620	1.956	2.402	1.968	28.92	59.65	29.05
B	143928	2.063	3.917	3.925	2.753	1.470	1.957	2.402	1.968	28.79	55.76	28.90
C	143946	1.369	3.162	4.089	3.204	1.798	1.956	2.402	1.968	28.74	56.75	28.87
D	144012	0.972	2.776	3.996	3.372	1.981	1.947	2.402	1.968	28.71	60.45	28.84
E	144033	0.230	0.981	1.659	2.759	1.434	1.966	2.402	1.968	28.61	57.95	28.71
F	144054	0.335	0.119	0.706	1.114	0.674	1.950	2.402	1.968	28.59	62.22	28.70
G	144117	-0.062	0.121	1.155	1.598	1.529	1.950	2.402	1.968	28.60	59.84	28.64
H	144133	0.869	2.757	3.052	2.564	1.694	1.956	2.402	1.968	28.53	58.70	28.56
I	144151	1.352	3.135	3.828	2.375	0.778	1.956	2.402	1.968	28.55	61.35	28.57
J	144210	0.994	2.033	1.881	1.001	0.651	1.950	2.402	1.968	28.54	58.58	28.56
K	144227	0.622	0.934	0.686	0.293	0.464	1.956	2.402	1.968	28.51	57.68	28.52
L	144245	0.603	0.427	0.488	0.751	1.066	1.956	2.402	1.968	28.53	55.41	28.52
M	144338	-0.020	-0.262	-0.277	-0.553	-0.190	1.950	2.401	1.968	28.50	55.80	28.50
N	144358	-0.201	-0.515	-0.496	-0.294	-0.241	1.969	2.402	1.968	28.50	55.42	28.49
O	144415	-0.239	-0.548	-0.191	-0.054	-0.214	1.966	2.402	1.968	28.49	56.35	28.48
P	144432	0.357	0.358	0.337	0.379	-0.062	1.956	2.402	1.968	28.44	61.98	28.45
Q	144451	1.077	1.536	1.118	0.917	0.819	1.966	2.401	1.968	28.46	60.77	28.47
R	144510	0.975	1.163	1.380	1.183	1.015	1.956	2.401	1.968	28.43	61.01	28.46
S	144532	0.972	1.478	2.017	1.927	1.479	1.950	2.401	1.964	28.35	61.83	28.45
T	144551	0.748	2.099	3.468	3.310	2.418	1.956	2.402	1.968	28.40	61.56	28.51
U	144612	0.576	2.396	4.427	4.645	3.080	1.977	2.401	1.964	28.33	55.35	28.43
V	144632	1.635	4.269	6.117	4.530	2.387	1.950	2.401	1.964	28.30	60.18	28.40
W	144649	1.904	4.460	5.136	2.621	0.537	1.956	2.401	1.968	28.29	60.92	28.40
X	144709	2.464	3.819	3.549	1.516	0.567	1.966	2.401	1.968	28.23	60.41	28.35
	144751						2.148	2.582	2.027	31.08	66.99	31.15
	144809	0.000	0.000	0.000	0.000	0.000	2.304	2.818	2.130	34.28	71.48	34.40
A	144849	1.978	3.033	2.691	1.109	0.544	2.341	2.849	2.226	34.33	71.29	34.49
B	144908	2.558	4.627	4.698	3.150	0.994	2.354	2.849	2.226	34.26	73.53	34.41
C	144929	1.561	4.491	5.305	3.487	1.880	2.359	2.849	2.226	34.21	68.02	34.35
D	144954	0.939	3.392	5.148	3.952	2.111	2.341	2.850	2.230	34.21	70.65	34.35
E	145018	0.012	0.991	2.486	3.032	1.738	2.341	2.850	2.230	34.13	68.42	34.27
F	145037	0.211	0.015	0.679	1.345	0.850	2.351	2.850	2.229	34.11	68.76	34.28
G	145057	-0.194	0.218	1.344	2.090	1.961	2.344	2.850	2.230	34.09	70.35	34.15
H	145115	0.879	3.166	4.289	3.804	2.163	2.342	2.851	2.229	34.08	71.02	34.14
I	145132	1.697	4.352	5.321	3.715	1.531	2.334	2.850	2.229	34.02	69.22	34.06
J	145150	1.667	4.113	3.281	0.998	0.112	2.341	2.850	2.233	34.03	67.07	34.07
K	145208	1.191	2.149	1.211	0.105	0.058	2.351	2.850	2.233	34.00	70.32	34.03
L	145230	0.819	0.767	0.386	0.563	0.836	2.341	2.850	2.233	34.00	69.30	34.02
M	145305	0.189	0.231	0.001	-0.008	-0.199	2.354	2.850	2.233	33.93	69.71	33.96
N	145324	-0.254	-0.100	-0.065	0.035	-0.015	2.333	2.850	2.234	33.92	71.23	33.96
O	145341	-0.358	-0.467	-0.190	0.092	0.040	2.341	2.850	2.233	33.90	69.18	33.93
P	145400	0.136	0.139	0.039	0.270	0.033	2.361	2.851	2.233	33.88	71.39	33.92
Q	145418	0.685	1.440	0.708	0.669	0.701	2.361	2.851	2.234	33.85	72.30	33.89
R	145435	0.852	1.196	1.451	0.701	0.380	2.362	2.851	2.233	33.87	65.93	33.89
S	145455	0.718	1.000	1.803	1.796	1.697	2.354	2.850	2.230	33.78	66.02	33.92

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
T	145516	0.308	1.805	3.518	4.058	3.085	2.341	2.850	2.233	33.79	69.85	33.94
U	145536	0.481	3.114	5.461	6.016	3.860	2.345	2.851	2.229	33.75	67.28	33.90
V	145557	1.857	5.704	7.412	5.563	2.303	2.368	2.851	2.233	33.73	66.75	33.87
W	145617	2.546	6.103	5.762	3.056	0.402	2.341	2.851	2.233	33.70	67.37	33.88
X	145637	2.772	4.086	3.920	1.479	0.308	2.359	2.850	2.233	33.71	66.67	33.88
	150012						2.478	3.002	2.439	35.86	77.35	35.96
	150031	0.000	0.000	0.000	0.000	0.000	2.670	3.229	2.656	38.97	80.95	39.08
A	150103	2.290	3.721	2.703	0.946	0.159	2.681	3.230	2.656	38.64	79.69	38.83
B	150125	3.006	5.885	5.318	3.041	0.868	2.664	3.231	2.656	38.54	79.86	38.73
C	150146	1.854	4.970	6.301	4.578	2.193	2.670	3.230	2.656	38.42	75.89	38.60
D	150203	0.756	3.640	5.966	5.282	3.156	2.673	3.231	2.656	38.39	81.42	38.59
E	150223	-0.277	0.420	2.460	4.017	2.486	2.664	3.230	2.656	38.35	82.14	38.53
F	150242	0.066	-0.259	0.541	1.410	1.161	2.664	3.230	2.656	38.30	79.45	38.47
G	150304	-0.350	-0.078	1.333	2.336	2.309	2.656	3.230	2.656	38.27	78.00	38.39
H	150323	0.537	2.727	4.737	4.610	2.830	2.664	3.231	2.656	38.25	78.53	38.38
I	150345	1.795	5.052	6.478	4.668	1.719	2.661	3.230	2.656	38.19	78.52	38.31
J	150403	2.246	5.234	4.798	1.583	-0.062	2.664	3.231	2.656	38.16	79.56	38.28
K	150420	1.822	3.352	1.721	-0.195	-0.064	2.664	3.231	2.656	38.20	81.19	38.30
L	150436	1.182	1.063	0.360	0.213	0.601	2.654	3.231	2.656	38.13	76.09	38.22
M	150510	0.433	1.084	0.758	0.305	-0.226	2.644	3.230	2.656	38.13	77.68	38.24
N	150531	0.355	1.797	2.319	1.228	0.679	2.673	3.231	2.656	38.06	75.92	38.17
O	150549	-0.675	0.601	1.977	2.223	1.177	2.663	3.230	2.657	38.06	82.03	38.18
P	150606	-0.768	-0.779	-0.114	1.036	0.945	2.656	3.231	2.656	38.12	74.89	38.22
Q	150625	0.335	-0.229	-0.887	0.105	0.912	2.670	3.233	2.656	38.08	78.06	38.18
R	150642	0.804	0.989	0.260	-0.045	0.295	2.681	3.233	2.659	38.04	76.21	38.14
S	150705	0.655	0.661	1.454	1.975	1.881	2.663	3.233	2.660	37.96	74.72	38.16
T	150728	0.122	1.143	3.365	4.469	3.632	2.670	3.233	2.656	37.96	78.70	38.15
U	150754	0.376	3.035	5.927	6.824	4.519	2.670	3.233	2.660	37.91	81.47	38.10
V	150817	2.083	6.253	8.260	6.311	2.319	2.663	3.234	2.657	37.88	80.45	38.08
W	150837	2.954	6.586	6.652	2.920	0.252	2.661	3.234	2.659	37.90	78.32	38.13
X	150856	3.052	4.880	3.609	0.987	0.271	2.656	3.233	2.656	37.87	75.18	38.10
	150947						2.873	3.461	2.728	41.03	84.37	41.18
	151011	0.000	0.000	0.000	0.000	0.000	3.028	3.704	3.048	43.80	89.69	43.97
A	151058	2.749	4.042	2.673	0.472	0.021	3.031	3.719	3.069	43.50	91.73	43.74
B	151120	3.700	6.835	5.899	3.229	0.608	3.020	3.719	3.069	43.40	88.31	43.65
C	151143	2.257	6.037	7.421	5.154	2.582	3.028	3.719	3.069	43.29	89.70	43.53
D	151200	0.663	3.808	7.003	5.729	3.053	3.038	3.719	3.069	43.20	86.46	43.45
E	151221	-0.418	0.016	2.277	4.737	3.368	3.020	3.719	3.069	43.16	90.83	43.39
F	151243	0.074	-0.617	0.415	1.574	1.332	3.038	3.719	3.069	43.11	88.40	43.34
G	151308	-0.476	-0.589	1.244	2.502	2.720	3.028	3.719	3.069	43.08	86.13	43.24
H	151329	0.262	2.004	4.949	5.532	3.571	3.038	3.719	3.069	43.04	91.40	43.19
I	151350	1.951	5.661	7.819	5.902	2.354	3.028	3.719	3.069	42.97	84.68	43.12
J	151407	2.914	6.428	6.245	2.078	-0.321	3.028	3.719	3.069	42.99	87.08	43.14
K	151425	2.648	5.163	2.395	-0.772	-0.531	3.028	3.719	3.069	42.94	88.86	43.06

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Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
L	151442	1.794	1.481	0.314	-0.102	0.477	3.028	3.719	3.069	42.94	88.24	43.06
M	151514	0.864	1.656	1.301	0.476	-0.194	3.021	3.719	3.069	42.86	89.59	42.99
N	151531	0.828	2.937	3.789	1.959	0.489	3.038	3.719	3.069	42.86	88.64	43.00
O	151548	-0.822	0.257	3.406	3.680	1.694	3.048	3.719	3.069	42.81	87.88	42.97
P	151606	-1.320	-2.162	0.067	1.720	1.708	3.028	3.719	3.069	42.80	84.26	42.94
Q	151626	0.244	-1.434	-2.038	-0.421	1.064	3.021	3.719	3.069	42.77	88.91	42.92
R	151646	0.888	0.679	-0.286	-0.638	0.080	3.028	3.719	3.069	42.73	84.24	42.89
S	151709	0.631	0.167	1.133	2.247	2.180	3.028	3.719	3.069	42.67	86.31	42.89
T	151731	-0.015	0.579	3.166	4.899	4.285	3.038	3.719	3.069	42.66	86.04	42.90
U	151752	0.316	2.879	6.447	7.803	5.328	3.038	3.719	3.069	42.62	90.58	42.85
V	151814	2.380	7.101	9.386	6.926	2.969	3.020	3.719	3.069	42.59	83.47	42.84
W	151835	3.692	8.017	6.979	2.877	0.123	3.028	3.719	3.069	42.59	83.60	42.85
X	151859	3.705	4.970	3.743	1.179	0.495	3.021	3.719	3.069	42.53	84.65	42.79
	151955						3.241	3.916	3.265	45.51	97.23	45.68
	152012	0.000	0.000	0.000	0.000	0.000	3.412	4.143	3.423	48.29	101.91	48.45
A	152117	3.074	4.736	2.588	0.005	-0.221	3.461	4.215	3.482	48.24	97.48	48.50
B	152143	3.862	8.277	6.234	2.693	0.318	3.461	4.215	3.481	48.08	97.90	48.34
C	152203	2.157	6.908	8.461	5.593	2.343	3.461	4.215	3.482	47.99	98.77	48.24
D	152223	0.316	3.868	7.658	7.087	3.818	3.478	4.215	3.482	47.90	101.30	48.15
E	152246	-0.910	-0.490	2.344	5.378	3.817	3.467	4.215	3.482	47.81	101.61	48.07
F	152308	-0.017	-0.629	-0.052	1.348	1.705	3.478	4.215	3.484	47.83	95.56	48.08
G	152331	-0.654	-0.862	1.018	2.651	3.042	3.467	4.215	3.482	47.70	96.44	47.89
H	152351	-0.306	1.783	5.050	6.668	4.596	3.461	4.215	3.482	47.65	95.33	47.82
I	152413	1.450	5.764	8.898	6.682	2.458	3.467	4.215	3.482	47.62	95.46	47.79
J	152431	3.231	7.996	7.388	2.954	0.040	3.461	4.215	3.481	47.58	97.05	47.73
K	152453	3.418	6.297	3.265	-0.550	-0.564	3.468	4.215	3.484	47.52	94.63	47.69
L	152509	2.306	2.341	0.117	-0.741	0.385	3.468	4.215	3.484	47.54	96.27	47.70
M	152547	0.951	2.534	1.546	0.205	-0.138	3.477	4.215	3.482	47.41	93.63	47.59
N	152610	0.817	3.609	4.224	2.859	0.772	3.478	4.215	3.482	47.41	96.51	47.58
O	152628	-1.384	0.252	3.943	4.973	2.367	3.467	4.215	3.481	47.35	95.40	47.52
P	152648	-1.993	-3.385	-0.677	2.418	2.440	3.461	4.215	3.481	47.32	94.73	47.50
Q	152712	-0.039	-1.942	-3.091	-1.354	0.923	3.467	4.215	3.482	47.29	94.30	47.47
R	152729	0.903	0.381	-0.894	-0.939	-0.066	3.478	4.215	3.481	47.27	94.41	47.47
S	152756	0.406	-0.173	0.426	2.058	2.579	3.461	4.215	3.482	47.20	94.09	47.46
T	152813	-0.494	0.148	2.858	4.881	4.635	3.470	4.215	3.482	47.17	99.78	47.43
U	152833	-0.079	2.668	6.597	8.597	6.084	3.467	4.215	3.481	47.08	96.85	47.35
V	152855	2.231	7.891	10.353	7.560	2.637	3.467	4.215	3.482	47.07	93.84	47.36
W	152918	4.062	8.852	7.590	2.603	-0.384	3.461	4.215	3.481	47.06	95.09	47.36
X	152939	4.436	5.952	3.876	0.911	1.387	3.461	4.215	3.481	47.03	94.80	47.32
	153205						3.690	4.479	3.719	50.61	104.14	50.76

Beam C-2 - December 16, 1991

											Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
	153227	0.000	0.000	0.000	0.000	0.000	3.937	4.737	3.843	53.16	109.32	53.26
A	153402	3.964	5.247	1.918	-0.464	-0.668	3.934	4.740	3.843	51.85	109.35	51.97
B	153424	4.419	10.084	6.789	2.567	-0.089	3.945	4.740	3.843	51.76	106.38	51.87
C	153444	2.144	7.667	9.840	6.102	1.922	3.962	4.740	3.842	51.64	106.31	51.74
D	153501	0.042	3.766	8.761	8.462	3.919	3.945	4.740	3.843	51.56	106.70	51.67
E	153522	-0.993	-0.899	2.266	6.281	4.439	3.945	4.740	3.843	51.50	106.83	51.59
F	153547	-0.181	-1.015	-0.321	1.658	1.895	3.952	4.741	3.842	51.41	108.05	51.51
G	153609	-0.749	-1.143	0.638	2.700	3.710	3.944	4.740	3.844	51.33	102.75	51.39
H	153628	-0.700	1.625	4.772	7.161	4.695	3.927	4.740	3.843	51.27	103.20	51.33
I	153650	1.231	5.761	9.980	7.365	2.481	3.945	4.740	3.843	51.23	108.13	51.29
J	153710	3.622	9.030	8.755	3.343	-0.271	3.955	4.740	3.843	51.20	105.34	51.25
K	153730	3.901	7.162	3.623	-0.506	-0.990	3.962	4.740	3.843	51.15	107.35	51.18
L	153749	2.728	2.575	0.060	-0.669	-0.010	3.955	4.740	3.843	51.14	105.15	51.18
M	153826	1.065	2.842	1.782	0.507	-0.442	3.962	4.741	3.842	51.03	103.24	51.08
N	153845	0.698	4.603	4.794	2.683	0.776	3.962	4.741	3.843	50.95	100.61	51.01
O	153902	-1.855	0.199	4.466	5.348	2.284	3.955	4.741	3.843	50.97	105.33	51.02
P	153920	-2.529	-4.237	-1.127	2.873	2.908	3.955	4.740	3.843	50.91	102.35	50.98
Q	153940	-0.240	-2.446	-4.142	-1.885	0.991	3.955	4.741	3.844	50.82	101.16	50.90
R	154002	0.856	0.036	-1.392	-1.611	-0.491	3.945	4.741	3.843	50.81	105.15	50.88
S	154026	0.445	-0.413	0.027	2.026	2.868	3.945	4.741	3.843	50.73	107.50	50.88
T	154050	-0.709	-0.448	2.412	5.241	5.385	3.955	4.741	3.843	50.70	104.36	50.85
U	154110	-0.277	2.477	7.190	9.860	7.118	3.962	4.740	3.843	50.62	100.28	50.79
V	154130	2.395	8.825	12.127	8.442	2.576	3.945	4.740	3.843	50.59	104.03	50.76
W	154150	4.881	10.846	8.294	2.628	-0.674	3.955	4.741	3.843	50.55	101.26	50.75
X	154214	5.043	6.458	3.759	0.736	-0.180	3.962	4.741	3.843	50.55	100.19	50.73
	154327						4.055	4.888	3.960	52.42	109.64	52.50
	154339						4.147	5.031	4.090	54.11	112.29	54.12
	154342						4.192	5.039	4.094	53.89	109.10	53.74
	154351						6.400	5.763	3.884	29.26	59.78	28.03
	154644						2.812	2.487	1.290	0.06	1.37	-0.02

Beam C-3 - December 17, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
										Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
	84208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.07	0.09	0.02
A	84341	0.797	2.374	1.863	1.850	1.554	0.080	0.062	0.062	0.87	1.82	0.95
B	84359	0.883	1.625	1.899	1.685	1.278	0.071	0.061	0.059	0.87	1.82	0.95
C	84416	1.021	1.858	2.069	1.497	1.267	0.061	0.061	0.059	0.87	1.83	0.96
D	84433	1.452	1.299	1.446	1.254	1.017	0.055	0.061	0.055	0.91	1.89	0.98
E	84451	0.818	1.358	1.803	1.417	1.238	0.071	0.061	0.059	0.91	1.87	0.96
F	84509	1.374	1.822	2.236	1.958	1.829	0.071	0.061	0.059	0.92	1.91	0.99
G	84534	0.468	0.288	0.847	1.080	1.101	0.055	0.061	0.059	0.93	1.86	0.93
H	84552	0.483	1.093	1.202	1.260	1.582	0.061	0.061	0.059	0.95	1.89	0.94
I	84613	0.882	1.289	1.318	1.771	1.039	0.055	0.061	0.059	0.93	1.84	0.91
J	84649	1.028	1.646	2.343	1.978	1.361	0.071	0.061	0.059	0.92	1.83	0.91
K	84705	1.247	1.715	1.800	1.470	1.099	0.088	0.061	0.059	0.92	1.80	0.88
L	84739	-0.256	-0.650	-0.775	-0.826	-0.525	0.055	0.061	0.059	0.93	1.82	0.89
M	84759	-0.750	-1.634	-2.236	-1.924	-1.289	0.088	0.061	0.059	0.89	1.75	0.86
N	84813	-0.589	-1.524	-2.085	-1.250	-0.959	0.088	0.061	0.059	0.91	1.80	0.89
O	84831	-0.276	-0.677	-0.839	-0.617	-0.623	0.055	0.061	0.059	0.89	1.76	0.87
P	84847	0.251	0.167	0.321	0.816	0.367	0.055	0.061	0.059	0.88	1.75	0.87
Q	84906	0.661	0.555	0.917	1.111	1.058	0.074	0.061	0.059	0.88	1.75	0.87
R	84928	-0.415	-0.731	-0.691	-0.508	-0.187	0.080	0.061	0.059	0.83	1.73	0.90
S	84947	-0.547	-1.239	-1.357	-0.999	-0.695	0.088	0.061	0.059	0.82	1.72	0.90
T	85006	-0.352	-0.891	-1.089	-0.886	-0.969	0.055	0.061	0.055	0.80	1.68	0.88
U	85022	0.275	0.842	0.233	0.043	0.036	0.071	0.061	0.059	0.80	1.68	0.88
V	85041	0.570	1.400	1.780	1.297	0.920	0.061	0.061	0.059	0.79	1.66	0.87
W	85101	1.079	2.592	2.837	2.288	2.314	0.080	0.061	0.059	0.80	1.72	0.92
X	85114	0.941	2.219	2.748	2.232	1.213	0.071	0.061	0.059	0.78	1.66	0.88
	85230						0.110	0.128	0.062	2.35	4.76	2.41
	85300						0.319	0.372	0.220	5.00	10.02	5.02
	85325						0.439	0.566	0.389	7.23	14.47	7.24
	85400	0.000	0.000	0.000	0.000	0.000	0.703	0.805	0.585	9.77	19.59	9.82
A	85434	0.896	2.111	1.854	1.905	1.504	0.685	0.805	0.585	9.62	19.39	9.77
B	85452	0.853	1.644	1.916	1.729	1.293	0.685	0.805	0.585	9.60	19.32	9.72
C	85510	0.885	1.774	2.172	1.685	1.339	0.687	0.805	0.585	9.59	19.30	9.71
D	85531	1.381	1.110	1.543	1.435	1.037	0.693	0.805	0.585	9.53	19.19	9.66
E	85553	0.940	1.545	2.004	1.555	1.346	0.687	0.805	0.585	9.53	19.21	9.68
F	85612	1.419	1.909	2.133	2.054	1.838	0.706	0.805	0.585	9.53	19.19	9.66
G	85634	0.404	0.197	0.648	0.897	1.010	0.697	0.805	0.585	9.55	19.15	9.60
H	85650	0.151	0.523	0.735	0.928	1.058	0.687	0.805	0.582	9.53	19.11	9.58
I	85711	0.769	1.074	1.049	1.617	0.934	0.687	0.805	0.585	9.50	19.03	9.53
J	85732	1.017	1.709	2.030	1.991	1.658	0.687	0.805	0.585	9.47	18.99	9.52
K	85749	0.967	1.835	2.426	1.995	1.359	0.687	0.805	0.582	9.50	19.04	9.54
L	85807	1.209	1.899	1.802	1.479	1.084	0.714	0.805	0.585	9.49	19.00	9.51
M	85843	-0.405	-0.787	-0.654	-0.685	-0.416	0.706	0.805	0.585	9.44	18.93	9.49
N	85904	-0.746	-1.819	-2.409	-1.945	-1.257	0.697	0.805	0.585	9.41	18.88	9.47
O	85926	-0.642	-1.444	-1.931	-1.622	-1.263	0.687	0.805	0.585	9.41	18.88	9.47

Beam C-3 - December 17, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
P	85945	-0.103	-0.264	-0.530	-0.617	-0.939	0.693	0.805	0.585	9.42	18.87	9.45
Q	90005	0.389	0.677	1.261	1.272	0.370	0.687	0.805	0.585	9.38	18.81	9.43
R	90028	0.989	0.934	1.285	1.537	1.239	0.694	0.805	0.585	9.37	18.79	9.42
S	90051	-0.536	-0.836	-0.764	-0.535	-0.276	0.703	0.805	0.582	9.34	18.81	9.47
T	90109	-0.702	-1.292	-1.410	-1.031	-0.732	0.687	0.805	0.585	9.35	18.84	9.49
U	90130	-0.480	-0.852	-0.992	-0.701	-0.755	0.703	0.805	0.585	9.32	18.79	9.47
V	90154	0.177	0.622	0.467	0.197	0.063	0.693	0.805	0.585	9.33	18.79	9.46
W	90217	0.433	1.267	1.773	1.414	1.005	0.703	0.805	0.585	9.29	18.73	9.44
X	90242	0.716	2.190	2.692	2.237	1.357	0.693	0.805	0.585	9.29	18.74	9.45
	90341						0.887	0.980	0.651	11.72	23.53	11.81
	90359						1.050	1.231	0.922	14.54	29.20	14.66
	90415						1.352	1.477	1.139	17.17	34.50	17.33
	90435	0.000	0.000	0.000	0.000	0.000	1.557	1.722	1.211	19.57	39.30	19.73
A	90538	0.609	2.235	1.944	2.022	1.370	1.572	1.722	1.208	18.91	38.07	19.16
B	90558	0.783	2.007	2.060	2.019	1.653	1.575	1.722	1.211	18.81	37.86	19.05
C	90619	0.798	1.773	2.350	1.978	1.507	1.572	1.722	1.211	18.80	37.82	19.02
D	90642	1.172	1.405	1.346	1.530	1.264	1.583	1.722	1.208	18.70	37.62	18.92
E	90705	0.928	1.397	1.755	1.674	1.208	1.576	1.722	1.208	18.66	37.52	18.86
F	90726	1.776	2.455	2.684	2.932	3.061	1.581	1.722	1.211	18.58	37.36	18.78
G	90749	0.283	0.152	0.431	0.799	0.880	1.572	1.722	1.211	18.57	37.27	18.70
H	90810	0.089	0.375	0.473	0.705	0.899	1.583	1.722	1.211	18.54	37.18	18.64
I	90833	0.548	0.858	0.714	1.564	1.032	1.572	1.722	1.208	18.49	37.09	18.60
J	90858	0.788	1.732	1.870	2.099	1.851	1.575	1.722	1.208	18.47	37.03	18.56
K	90918	0.941	1.845	2.519	2.246	1.423	1.590	1.722	1.211	18.44	36.96	18.52
L	90936	1.241	2.137	1.892	1.588	1.104	1.572	1.722	1.211	18.41	36.88	18.47
M	91015	-0.745	-1.061	-0.667	-0.640	-0.265	1.610	1.722	1.211	18.35	36.76	18.41
N	91032	-0.894	-2.268	-3.135	-2.216	-1.293	1.593	1.722	1.211	18.28	36.63	18.35
O	91053	-0.470	-1.077	-2.509	-2.399	-1.738	1.595	1.722	1.211	18.28	36.60	18.32
P	91115	0.372	0.790	0.119	-0.561	-1.351	1.575	1.723	1.211	18.22	36.50	18.28
Q	91135	0.576	1.480	2.041	1.933	0.646	1.610	1.723	1.211	18.18	36.40	18.22
R	91200	0.821	0.999	1.617	1.872	1.491	1.600	1.725	1.211	18.18	36.40	18.22
S	91222	-0.563	-0.856	-0.985	-0.718	-0.377	1.593	1.725	1.208	18.09	36.30	18.21
T	91244	-0.941	-1.589	-1.740	-1.142	-0.840	1.600	1.725	1.211	18.05	36.23	18.18
U	91303	-0.740	-1.126	-1.343	-0.738	-0.902	1.610	1.726	1.208	18.03	36.17	18.14
V	91323	-0.205	0.296	0.330	0.433	0.264	1.601	1.726	1.211	17.96	36.05	18.09
W	91341	0.178	1.069	1.873	1.808	1.136	1.590	1.726	1.211	17.98	36.09	18.11
X	91403	0.987	2.273	2.706	2.493	1.114	1.613	1.726	1.211	17.95	36.01	18.06
	91517						2.050	2.111	1.569	21.29	42.48	21.19
	91542						2.407	2.463	1.793	24.31	48.45	24.14
	91602						2.671	2.701	1.975	26.51	52.90	26.39

Beam C-3 - December 17, 1991

Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Forces (kN)		
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	Shear A/H - B/G	Load	Shear C/F - D/E
	91629	0.000	0.000	0.000	0.000	0.000	3.057	3.095	2.209	29.68	59.61	29.93
A	91743	0.760	2.244	2.233	2.195	1.672	3.049	3.095	2.205	28.83	58.01	29.18
B	91800	0.545	1.468	2.325	2.639	2.174	3.066	3.095	2.205	28.77	57.88	29.11
C	91817	-0.059	0.409	1.540	1.940	1.912	3.056	3.095	2.205	28.70	57.72	29.02
D	91839	0.388	-0.843	-0.577	0.462	1.072	3.067	3.095	2.209	28.64	57.60	28.96
E	91855	0.571	0.236	-0.023	0.283	0.570	3.067	3.095	2.209	28.62	57.57	28.95
F	91914	1.428	1.339	1.093	1.273	1.514	3.056	3.095	2.205	28.58	57.47	28.89
G	91937	0.361	-0.144	-0.002	0.321	0.682	3.056	3.095	2.205	28.58	57.40	28.82
H	91957	-0.190	-0.499	-0.651	-0.254	0.415	3.048	3.095	2.205	28.54	57.32	28.78
I	92017	0.008	-0.524	-0.594	0.863	0.854	3.056	3.095	2.209	28.47	57.19	28.72
J	92036	0.297	0.873	1.729	2.647	2.456	3.056	3.094	2.209	28.44	57.12	28.68
K	92056	1.022	2.264	3.484	3.108	1.993	3.056	3.095	2.205	28.43	57.10	28.67
L	92114	1.455	2.671	2.406	1.775	1.134	3.069	3.095	2.205	28.43	57.08	28.65
M	92144	-1.217	-1.685	-1.092	-0.605	-0.109	3.076	3.095	2.206	28.34	56.91	28.57
N	92206	-1.068	-3.203	-3.966	-2.693	-1.132	3.079	3.095	2.205	28.33	56.88	28.55
O	92226	-0.717	-0.972	-3.221	-3.462	-2.399	3.066	3.095	2.209	28.35	56.91	28.56
P	92247	1.063	1.710	0.390	-1.189	-2.159	3.076	3.095	2.205	28.25	56.75	28.50
Q	92308	0.755	2.235	3.081	2.252	0.711	3.066	3.094	2.209	28.24	56.72	28.48
R	92330	1.649	1.867	2.465	2.522	1.969	3.074	3.095	2.209	28.23	56.70	28.47
S	92357	-0.577	-1.176	-1.431	-1.284	-0.597	3.056	3.095	2.209	28.14	56.60	28.46
T	92414	-1.075	-2.300	-2.904	-2.207	-1.205	3.056	3.095	2.209	28.14	56.61	28.47
U	92434	-1.230	-2.547	-2.498	-1.133	-0.830	3.066	3.095	2.209	28.10	56.53	28.43
V	92452	-0.863	-0.427	0.177	0.993	1.022	3.056	3.095	2.209	28.10	56.55	28.45
W	92517	-0.058	0.929	2.575	2.796	1.560	3.049	3.095	2.209	28.06	56.45	28.39
X	92550	1.130	2.470	3.589	2.976	1.860	3.066	3.095	2.209	28.04	56.42	28.38
	92713						3.294	3.345	2.370	31.72	63.66	31.94
	92735	0.000	0.000	0.000	0.000	0.000	3.515	3.609	2.742	34.82	69.82	35.00
A	92825	0.338	1.649	2.165	2.524	1.595	3.489	3.609	2.742	34.22	68.71	34.49
B	92845	-0.540	-0.204	1.447	2.766	2.392	3.506	3.609	2.742	34.08	68.43	34.35
C	92914	-1.310	-2.217	-0.825	0.765	1.835	3.507	3.609	2.745	33.98	68.22	34.24
D	92938	-0.159	-2.867	-3.366	-1.618	0.298	3.506	3.609	2.742	33.91	68.06	34.15
E	92957	0.593	-0.233	-1.470	-1.339	-0.573	3.526	3.609	2.742	33.86	67.96	34.10
F	93017	1.560	1.410	0.744	0.816	1.091	3.499	3.609	2.738	33.78	67.78	34.00
G	93040	0.255	-0.216	-0.389	-0.408	0.185	3.523	3.609	2.742	33.75	67.67	33.92
H	93059	-0.241	-1.046	-1.990	-1.552	-0.213	3.509	3.609	2.742	33.73	67.61	33.88
I	93116	-0.603	-1.994	-2.382	-0.195	0.675	3.513	3.609	2.742	33.69	67.51	33.82
J	93136	-0.456	-0.314	1.002	2.839	2.631	3.489	3.609	2.742	33.65	67.46	33.81
K	93159	0.705	2.075	3.955	3.854	2.328	3.499	3.609	2.738	33.64	67.42	33.78
L	93215	1.582	3.035	2.772	2.100	1.207	3.489	3.609	2.742	33.57	67.27	33.70
M	93242	-1.440	-2.146	-0.950	-0.458	0.089	3.506	3.609	2.742	33.53	67.20	33.67
N	93303	-1.264	-3.952	-4.762	-2.922	-1.097	3.506	3.609	2.742	33.53	67.21	33.68
O	93325	0.106	-1.129	-3.925	-4.405	-2.927	3.506	3.609	2.742	33.50	67.14	33.64
P	93345	1.305	2.665	0.936	-1.299	-2.633	3.521	3.609	2.745	33.46	67.05	33.59
Q	93412	0.819	2.548	3.717	2.837	0.429	3.507	3.609	2.745	33.41	66.95	33.54
R	93436	1.765	1.879	2.894	3.145	2.110	3.506	3.609	2.742	33.37	66.88	33.51
S	93501	-0.537	-1.078	-1.524	-1.757	-0.948	3.523	3.609	2.742	33.34	66.89	33.55

Beam C-3 - December 17, 1991

										Forces (kN)		
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/E - B/G	Mid	C/F - D/E	A/E - B/G		C/F - D/E
T	93519	-1.158	-2.657	-3.985	-3.407	-1.907	3.489	3.609	2.742	33.30	66.82	33.52
U	93538	-1.796	-3.850	-4.287	-2.333	-1.273	3.523	3.609	2.742	33.26	66.75	33.49
V	93606	-1.934	-2.412	-1.339	0.562	1.103	3.523	3.609	2.745	33.23	66.69	33.46
W	93632	-1.020	-0.042	2.311	3.244	2.089	3.506	3.609	2.745	33.19	66.62	33.43
X	93655	0.851	2.266	3.581	3.311	1.528	3.506	3.609	2.745	33.14	66.53	33.39
	93746						3.743	3.838	2.828	36.33	72.81	36.48
	93830	0.000	0.000	0.000	0.000	0.000	3.980	4.197	3.124	39.19	78.54	39.35
A	93923	-1.736	-2.563	-0.455	2.181	2.713	3.990	4.197	3.127	38.71	77.64	38.93
B	93941	-2.165	-4.609	-3.659	-0.940	1.208	3.983	4.197	3.127	38.65	77.47	38.82
C	94001	0.014	-3.401	-5.179	-3.506	-0.988	3.990	4.197	3.127	38.57	77.31	38.74
D	94022	1.251	0.469	-1.621	-2.291	-1.562	4.004	4.197	3.127	38.46	77.08	38.62
E	94051	2.002	2.147	1.083	0.533	0.744	3.990	4.197	3.127	38.38	76.91	38.53
F	94113	0.737	-0.109	-0.714	-0.917	-0.331	3.991	4.197	3.127	38.34	76.76	38.42
G	94132	-0.080	-1.655	-3.135	-2.740	-0.938	3.990	4.197	3.127	38.30	76.68	38.38
H	94153	-0.859	-3.458	-4.061	-1.116	0.549	3.994	4.198	3.127	38.23	76.53	38.30
I	94219	-1.220	-1.952	0.061	2.849	3.006	3.993	4.198	3.128	38.18	76.43	38.25
J	94240	0.313	1.706	4.132	4.188	2.453	3.994	4.198	3.130	38.14	76.35	38.21
K	94302	1.384	3.150	3.015	2.436	1.133	3.983	4.198	3.127	38.12	76.31	38.19
L	94329	-2.205	-2.976	-1.179	-0.217	0.215	3.994	4.198	3.127	38.08	76.22	38.14
M	94352	-2.056	-5.511	-5.996	-3.316	-1.030	3.983	4.198	3.131	38.05	76.16	38.11
N	94417	0.011	-2.224	-5.475	-5.822	-3.564	3.976	4.198	3.127	37.96	75.99	38.03
O	94436	1.774	2.683	0.219	-2.485	-4.093	3.983	4.198	3.131	37.95	75.98	38.03
P	94459	1.135	2.822	3.828	2.235	-0.337	3.990	4.198	3.131	37.93	75.93	38.00
Q	94525	2.070	2.225	3.226	3.020	2.005	3.993	4.199	3.131	37.87	75.82	37.95
R	94548	-0.369	-0.729	-1.581	-2.105	-1.404	3.990	4.199	3.131	37.81	75.78	37.97
S	94614	-0.674	-2.708	-4.845	-4.693	-2.901	3.986	4.199	3.131	37.76	75.70	37.94
T	94632	-1.794	-5.013	-6.189	-3.837	-1.906	3.990	4.199	3.131	37.76	75.70	37.94
U	94656	-2.742	-4.478	-3.168	-0.247	1.468	3.983	4.199	3.131	37.75	75.68	37.93
V	94717	-2.008	-1.932	1.203	3.343	2.362	3.990	4.199	3.131	37.69	75.57	37.88
W	94746	0.461	2.066	3.426	3.735	1.773	3.986	4.199	3.128	37.65	75.49	37.84
X	94846	0.071	0.019	-0.003	0.015	-0.037	4.292	4.474	3.237	41.50	83.10	41.60
	94907						4.577	4.810	3.612	44.48	89.04	44.56
	95010	-1.386	-0.846	0.831	2.583	2.249	4.594	4.819	3.616	43.58	87.28	43.70
A	95030	-3.044	-4.994	-2.896	1.071	2.780	4.594	4.819	3.616	43.41	86.95	43.54
B	95048	-2.512	-6.292	-6.377	-3.050	0.360	4.594	4.819	3.616	43.34	86.79	43.45
C	95110	0.944	-2.258	-6.368	-5.594	-2.466	4.615	4.819	3.616	43.23	86.56	43.33
D	95130	2.003	2.039	-1.116	-2.951	-2.890	4.587	4.819	3.616	43.17	86.43	43.26
E	95146	2.424	2.877	1.851	0.927	0.257	4.598	4.819	3.616	43.08	86.27	43.19
F	95204	0.850	-0.141	-1.242	-2.008	-1.230	4.594	4.819	3.616	43.06	86.16	43.10
G	95225	0.015	-2.014	-4.356	-4.282	-2.039	4.615	4.819	3.616	43.01	86.05	43.04
H	95247	-1.418	-4.541	-5.173	-1.488	1.042	4.605	4.819	3.619	42.98	85.97	42.99
I	95302	-2.146	-2.945	-0.153	3.057	4.598	4.605	4.819	3.616	42.91	85.84	42.93
J	95320	-2.179	-3.270	-0.851	2.759	3.475	4.615	4.819	3.616	42.89	85.78	42.89
K	95345	-0.352	1.458	4.406	4.436	2.704	4.612	4.819	3.615	42.87	85.74	42.87

Beam C-3 - December 17, 1991

											Forces (kN)	
Loc.	Time	Web out of Plane Deflection (mm)					Vertical Deflection (mm)			Shear	Load	Shear
		Top	2	3	4	Bot.	A/H - B/G	Mid	C/F - D/E	A/H - B/G		C/F - D/E
L	95409	1.253	3.518	3.358	2.534	1.231	4.588	4.819	3.616	42.80	85.58	42.78
M	95436	-3.164	-4.014	-1.493	-0.051	0.300	4.605	4.819	3.619	42.74	85.49	42.75
N	95453	-2.676	-6.923	-7.085	-3.538	-0.746	4.598	4.819	3.612	42.72	85.46	42.74
O	95510	0.157	-2.345	-6.565	-6.999	-3.976	4.595	4.819	3.619	42.65	85.32	42.67
P	95533	2.059	2.927	-0.014	-3.269	-4.963	4.595	4.819	3.619	42.59	85.22	42.63
Q	95556	1.188	3.359	4.048	2.066	-0.690	4.588	4.819	3.616	42.53	85.12	42.59
R	95620	2.038	2.269	3.254	3.148	2.178	4.605	4.819	3.616	42.52	85.09	42.57
S	95641	-0.122	-0.197	-1.346	-2.758	-2.237	4.605	4.819	3.616	42.45	85.03	42.58
T	95659	-0.186	-2.136	-5.693	-6.705	-4.478	4.594	4.819	3.616	42.42	84.96	42.54
U	95723	-2.214	-6.630	-9.112	-6.471	-3.460	4.605	4.819	3.616	42.38	84.90	42.52
V	95747	-4.845	-8.235	-6.573	-2.196	0.611	4.605	4.819	3.616	42.36	84.89	42.53
W	95810	-5.033	-5.182	-0.966	2.516	2.696	4.615	4.819	3.616	42.34	84.85	42.51
X	95837	-1.157	0.395	3.142	3.412	1.982	4.608	4.819	3.616	42.28	84.72	42.44
	95951						4.918	5.188	3.860	46.57	93.23	46.66
	100012	0.000	0.000	0.000	0.000	0.000	5.182	5.554	4.392	49.51	99.22	49.71
A	100128	-2.815	-2.643	-0.139	2.606	2.330	5.199	5.564	4.393	48.04	96.36	48.32
B	100157	-4.344	-7.552	-5.136	-0.107	2.624	5.199	5.564	4.393	47.82	95.93	48.11
C	100224	-2.414	-7.402	-8.682	-5.195	-0.662	5.199	5.564	4.393	47.68	95.65	47.97
D	100246	1.753	-0.922	-6.866	-7.273	-4.208	5.213	5.564	4.393	47.55	95.40	47.85
E	100307	2.498	3.748	0.373	-3.018	-3.946	5.219	5.564	4.394	47.48	95.25	47.77
F	100327	2.313	3.565	2.755	0.925	-0.281	5.199	5.564	4.393	47.37	95.02	47.65
G	100349	1.010	0.177	-1.725	-3.139	-2.348	5.223	5.564	4.394	47.31	94.84	47.53
H	100409	0.231	-2.464	-5.990	-6.301	-3.340	5.192	5.564	4.394	47.26	94.73	47.47
I	100431	-1.762	-6.367	-7.799	-3.722	0.172	5.219	5.564	4.394	47.21	94.64	47.43
J	100448	-3.877	-6.221	-2.577	1.751	3.470	5.219	5.564	4.394	47.16	94.53	47.37
K	100508	-2.417	-0.573	4.046	4.696	2.788	5.209	5.564	4.393	47.10	94.40	47.30
L	100528	0.484	3.310	3.398	2.671	1.112	5.220	5.564	4.393	47.07	94.34	47.27
M	100600	-4.602	-4.973	-1.488	0.283	0.433	5.212	5.564	4.394	46.95	94.11	47.16
N	100620	-3.205	-8.689	-8.466	-3.902	-0.663	5.223	5.564	4.394	46.91	94.04	47.13
O	100642	0.202	-3.433	-8.531	-9.148	-4.459	5.203	5.564	4.396	46.85	93.91	47.06
P	100704	2.158	3.064	-0.366	-4.063	-6.207	5.219	5.564	4.394	46.81	93.85	47.04
Q	100726	1.461	3.741	4.468	1.934	-1.168	5.219	5.564	4.394	46.74	93.72	46.98
R	100748	2.033	2.635	3.584	3.534	2.092	5.209	5.564	4.394	46.71	93.65	46.94
S	100809	0.032	0.287	-1.073	-3.147	-3.054	5.220	5.564	4.393	46.60	93.52	46.92
T	100829	0.258	-1.767	-6.291	-8.192	-5.855	5.209	5.564	4.393	46.58	93.48	46.90
U	100853	-2.111	-7.561	-11.292	-8.208	-4.189	5.223	5.564	4.394	46.55	93.42	46.87
V	100917	-5.985	-10.973	-8.586	-2.961	0.612	5.223	5.564	4.394	46.49	93.30	46.81
W	100945	-7.141	-7.043	-1.491	2.684	2.877	5.226	5.564	4.393	46.46	93.25	46.79
X	101014	-2.025	0.813	3.509	4.250	2.423	5.220	5.564	4.393	46.40	93.14	46.74
	101134						5.694	6.161	4.868	50.75	101.97	51.22
	101136						5.714	6.180	4.872	50.86	102.22	51.36
	101301						6.566	10.086	11.395	25.56	52.71	27.15

APPENDIX C

Plane Frame Model Results

Plane Frame Model Results

The following pages show the results of the plane frame modelling program as well as the input data for the Type A, B and C beams. Node and element numbering used is shown in Figure 5.3.

The first section of input data shown includes the node number, a code to indicate whether the fifth, sixth and seventh columns indicated a boundary restraint or an applied force. A '1' indicates that the corresponding column is a fixed boundary condition. The third and fourth columns are the X and Y coordinates of the node. The fifth, sixth and seventh columns indicate the magnitude and direction of the applied force or moment, or can indicate the displacement of the boundary nodes.

The second section of input data shows the information related to the model elements. The first three columns show the element number, number of the node at the first end of the element and the number of the node at the second end of the element. The fourth column is a code which indicate how the element is connected to the rest of the structure. A '0' indicates that both ends of the element are fixed. A '1' indicates that the first end of the element is free to rotate, A '2' indicates that the second end of the element is free to rotate. A '3' indicates that both ends of the element are free to rotate, the element is a truss element. The fifth, sixth and seventh columns are the element cross-sectional area, moment of inertia, and elastic modulus.

The first section of output includes the node number and the node displacement in the horizontal and vertical direction and the rotation of the node. The second section of the output shows the element number, axial force resisted by the element, cross-sectional area of the element and the element's axial stress.

Beam A Model

```
NUMBER OF JOINTS        66
NUMBER OF ELEMENTS     135
NUMBER OF LOADS          0

JOINT DATA

NODE KODE      X       Y       U       V       R

   1   10    38.0    44.5    0.0     0.0     0.0
   2    0    38.0   148.7    0.0     0.0     0.0
   3    0   152.4    44.5    0.0     0.0     0.0
   4    0    38.0   252.9    0.0     0.0     0.0
   5    0   152.4   148.7    0.0     0.0     0.0
   6    0   266.8    44.5    0.0     0.0     0.0
   7    0    38.0   357.1    0.0     0.0     0.0
   8    0   152.4   252.9    0.0     0.0     0.0
   9    0   266.8   148.7    0.0     0.0     0.0
  10    0   381.2    44.5    0.0     0.0     0.0
  11    0    38.0   461.3    0.0     0.0     0.0
  12    0   152.4   357.1    0.0     0.0     0.0
  13    0   266.8   252.9    0.0     0.0     0.0
  14    0   381.2   148.7    0.0     0.0     0.0
  15    0   495.6    44.5    0.0     0.0     0.0
  16    0    38.0   565.5    0.0     0.0     0.0
  17    0   152.4   461.3    0.0     0.0     0.0
  18    0   266.8   357.1    0.0     0.0     0.0
  19    0   381.2   252.9    0.0     0.0     0.0
  20    0   495.6   148.7    0.0     0.0     0.0
  21    0   610.0    44.5    0.0     0.0     0.0
  22    0   152.4   565.5    0.0     0.0     0.0
  23    0   266.8   461.3    0.0     0.0     0.0
  24    0   381.2   357.1    0.0     0.0     0.0
  25    0   495.6   252.9    0.0     0.0     0.0
  26    0   610.0   148.7    0.0     0.0     0.0
  27    0   732.0    44.5    0.0     0.0     0.0
  28    0   266.8   565.5    0.0     0.0     0.0
  29    0   381.2   461.3    0.0     0.0     0.0
  30    0   495.6   357.1    0.0     0.0     0.0
  31    0   610.0   252.9    0.0     0.0     0.0
  32    0   732.0   148.7    0.0     0.0     0.0
  33    0   854.0    44.5    0.0     0.0     0.0
  34    0   381.2   565.5    0.0     0.0     0.0
  35    0   495.6   461.3    0.0     0.0     0.0
  36    0   610.0   357.1    0.0     0.0     0.0
```

Beam A Model

JOINT DATA

NODE	KODE	X	Y	U	V	R
37	0	732.0	252.9	0.0	0.0	0.0
38	0	854.0	148.7	0.0	0.0	0.0
39	0	976.0	44.5	0.0	0.0	0.0
40	0	495.6	565.5	0.0	0.0	0.0
41	0	610.0	461.3	0.0	0.0	0.0
42	0	732.0	357.1	0.0	0.0	0.0
43	0	854.0	252.9	0.0	0.0	0.0
44	0	976.0	148.7	0.0	0.0	0.0
45	0	1098.0	44.5	0.0	0.0	0.0
46	0	610.0	565.5	0.0	-33250.0	0.0
47	0	732.0	461.3	0.0	0.0	0.0
48	0	854.0	357.1	0.0	0.0	0.0
49	0	976.0	252.9	0.0	0.0	0.0
50	0	1098.0	148.7	0.0	0.0	0.0
51	101	1220.0	44.5	0.0	0.0	0.0
52	0	732.0	565.5	0.0	0.0	0.0
53	0	854.0	461.3	0.0	0.0	0.0
54	0	976.0	357.1	0.0	0.0	0.0
55	0	1098.0	252.9	0.0	0.0	0.0
56	101	1220.0	148.7	0.0	0.0	0.0
57	0	854.0	565.5	0.0	0.0	0.0
58	0	976.0	461.3	0.0	0.0	0.0
59	0	1098.0	357.1	0.0	0.0	0.0
60	101	1220.0	252.9	0.0	0.0	0.0
61	0	976.0	565.5	0.0	0.0	0.0
62	0	1098.0	461.3	0.0	0.0	0.0
63	101	1220.0	357.1	0.0	0.0	0.0
64	0	1098.0	565.5	0.0	0.0	0.0
65	101	1220.0	461.3	0.0	0.0	0.0
66	101	1220.0	565.5	0.0	0.0	0.0

Beam A Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
1	1	2	1	3910	1880000	985
2	2	3	0	533	264000	5308
3	1	5	0	533	264000	985
4	1	3	1	4310	2840000	9644
5	2	4	0	3910	1880000	6560
6	4	5	0	533	264000	5308
7	2	8	0	533	264000	985
8	5	6	0	533	264000	5308
9	3	9	0	533	264000	985
10	3	6	0	4310	2840000	9644
11	4	7	0	3910	1880000	6560
12	7	8	0	533	264000	5308
13	4	12	0	533	264000	985
14	8	9	0	533	264000	5308
15	5	13	0	533	264000	985
16	9	10	0	533	264000	5308
17	6	14	0	533	264000	985
18	6	10	0	4310	2840000	9644
19	7	11	0	3910	1880000	6560
20	11	12	0	533	264000	5308
21	7	17	0	533	264000	985
22	12	13	0	533	264000	5308
23	8	18	0	533	264000	985
24	13	14	0	533	264000	5308
25	9	19	0	533	264000	985
26	14	15	0	533	264000	5308
27	10	20	0	533	264000	985
28	10	15	0	4310	2840000	9644
29	11	16	2	3910	1880000	6560
30	16	22	0	4310	2840000	9644
31	16	17	0	533	264000	5308
32	11	22	0	533	264000	985
33	17	18	0	533	264000	5308
34	12	23	0	533	264000	985
35	18	19	0	533	264000	5308
36	13	24	0	533	264000	985
37	19	20	0	533	264000	5308
38	14	25	0	533	264000	985
39	20	21	0	533	264000	5308
40	15	26	0	533	264000	985

Beam A Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
41	15	21	0	4310	2840000	9644
42	22	28	0	4310	2840000	9644
43	22	23	0	533	264000	5308
44	17	28	0	533	264000	985
45	23	24	0	533	264000	5308
46	18	29	0	533	264000	985
47	24	25	0	533	264000	5308
48	19	30	0	533	264000	985
49	25	26	0	533	264000	5308
50	20	31	0	533	264000	985
51	26	27	0	533	264000	6560
52	21	26	1	1950	235000	5308
53	21	32	0	533	264000	5308
54	21	27	0	4310	2840000	9644
55	28	34	0	4310	2840000	9644
56	28	29	0	533	264000	5308
57	23	34	0	533	264000	985
58	29	30	0	533	264000	5308
59	24	35	0	533	264000	985
60	30	31	0	533	264000	5308
61	25	36	0	533	264000	985
62	31	32	0	533	264000	6560
63	26	31	0	1950	235000	5308
64	26	37	0	533	264000	5308
65	32	33	0	533	264000	5308
66	27	38	0	533	264000	5308
67	27	33	0	4310	2840000	9644
68	34	40	1	4310	2840000	9644
69	34	35	0	533	264000	5308
70	29	40	0	533	264000	985
71	35	36	0	533	264000	5308
72	30	41	0	533	264000	985
73	36	37	0	533	264000	6560
74	31	36	0	1950	235000	5308
75	31	42	0	533	264000	5308
76	37	38	0	533	264000	5308
77	32	43	0	533	264000	5308
78	38	39	0	533	264000	5308
79	33	44	0	533	264000	5308
80	33	39	0	4310	2840000	9644

Beam A Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
81	40	46	0	4310	2840000	9644
82	40	41	0	533	264000	5308
83	35	46	0	533	264000	985
84	41	42	0	533	264000	6560
85	36	41	0	1950	235000	5308
86	36	47	0	533	264000	5308
87	42	43	0	533	264000	5308
88	37	48	0	533	264000	5308
89	43	44	0	533	264000	5308
90	38	49	0	533	264000	5308
91	44	45	0	533	264000	5308
92	39	50	0	533	264000	5308
93	39	45	0	4310	2840000	9644
94	46	52	0	4310	2840000	9644
95	46	47	0	533	264000	6560
96	41	46	2	1950	235000	5308
97	41	52	0	533	264000	5308
98	47	48	0	533	264000	5308
99	42	53	0	533	264000	5308
100	48	49	0	533	264000	5308
101	43	54	0	533	264000	5308
102	49	50	0	533	264000	5308
103	44	55	0	533	264000	5308
104	50	51	0	533	264000	5308
105	45	56	0	533	264000	5308
106	45	51	0	4310	2840000	9644
107	51	56	1	977	118000	6560
108	52	57	0	4310	2840000	9644
109	52	53	0	533	264000	5308
110	47	57	0	533	264000	5308
111	53	54	0	533	264000	5308
112	48	58	0	533	264000	5308
113	54	55	0	533	264000	5308
114	49	59	0	533	264000	5308
115	55	56	0	533	264000	5308
116	50	60	0	533	264000	5308
117	56	60	0	977	118000	6560
118	57	61	0	4310	2840000	9644
119	57	58	0	533	264000	5308
120	53	61	0	533	264000	5308

Beam A Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
121	58	59	0	533	264000	5308
122	54	62	0	533	264000	5308
123	59	60	0	533	264000	5308
124	55	63	0	533	264000	5308
125	60	63	0	977	118000	6560
126	61	64	0	4310	2840000	9644
127	61	62	0	533	264000	5308
128	58	64	0	533	264000	5308
129	62	63	0	533	264000	5308
130	59	65	0	533	264000	5308
131	63	65	0	977	118000	6560
132	64	66	0	4310	2840000	9644
133	64	65	0	533	264000	5308
134	62	66	0	533	264000	5308
135	65	66	0	977	118000	6560

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
1	-0.65	+0.00	-1.25E-02
2	-0.09	-0.77	-4.14E-03
3	-0.65	-1.36	-1.14E-02
4	+0.32	-0.89	-3.64E-03
5	-0.04	-1.63	-6.24E-03
6	-0.64	-2.63	-1.07E-02
7	+0.64	-0.98	-2.50E-03
8	+0.21	-1.93	-7.29E-03
9	-0.17	-2.85	-5.50E-03
10	-0.61	-3.83	-1.02E-02
11	+0.81	-1.05	-8.70E-04
12	+0.44	-2.05	-8.01E-03
13	+0.04	-3.09	-6.12E-03
14	-0.23	-3.99	-5.19E-03
15	-0.57	-4.96	-9.18E-03
16	+0.80	-1.09	-1.29E-02
17	+0.34	-2.31	-5.67E-03

Beam A Model

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
18	+0.12	-3.25	-5.67E-03
19	-0.10	-4.15	-5.50E-03
20	-0.30	-5.02	-4.89E-03
21	-0.51	-5.87	-6.28E-03
22	+0.77	-2.57	-1.28E-02
23	+0.31	-3.66	-4.99E-03
24	+0.09	-4.46	-5.27E-03
25	-0.15	-5.26	-5.47E-03
26	-0.36	-6.02	-2.64E-03
27	-0.42	-6.42	-3.15E-03
28	+0.72	-4.01	-1.22E-02
29	+0.29	-4.88	-4.10E-03
30	+0.08	-5.52	-4.94E-03
31	-0.15	-6.17	-2.52E-03
32	-0.20	-6.42	-2.03E-03
33	-0.32	-6.72	-1.89E-03
34	+0.65	-5.38	-1.17E-02
35	+0.25	-5.98	-2.80E-03
36	+0.06	-6.35	-2.18E-03
37	-0.05	-6.53	-2.31E-03
38	-0.15	-6.76	-1.64E-03
39	-0.21	-6.90	-1.18E-03
40	+0.57	-6.16	-6.22E-03
41	+0.24	-6.54	-1.96E-03
42	+0.13	-6.65	-1.78E-03
43	+0.02	-6.78	-1.66E-03
44	-0.09	-6.95	-1.15E-03
45	-0.11	-7.01	-6.22E-04
46	+0.48	-6.73	-3.29E-03
47	+0.29	-6.82	-1.28E-03
48	+0.16	-6.88	-1.23E-03
49	+0.03	-6.99	-1.01E-03
50	-0.03	-7.06	-4.90E-04
51	+0.00	-7.05	+0.00E+00
52	+0.38	-6.94	-6.60E-04
53	+0.26	-6.93	-7.37E-04
54	+0.13	-6.99	-7.55E-04
55	+0.02	-7.06	-4.10E-04
56	+0.00	-7.06	+0.00E+00

Beam A Model

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
57	+0.29	-6.97	-3.19E-05
58	+0.18	-6.99	-3.88E-04
59	+0.06	-7.05	-2.51E-04
60	+0.00	-7.06	+0.00E+00
61	+0.19	-6.97	-8.25E-05
62	+0.09	-7.02	-1.64E-04
63	+0.00	-7.05	+0.00E+00
64	+0.10	-6.99	-1.94E-04
65	+0.00	-7.03	+0.00E+00
66	+0.00	-7.01	+0.00E+00

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
1	-28.5	3910	-7.29
2	-0.2	533	-0.38
3	-2.2	533	-4.13
4	0.9	4310	0.21
5	-28.6	3910	-7.31
6	4.2	533	7.88
7	-1.9	533	-3.56
8	4.3	533	8.07
9	-2.2	533	-4.13
10	3.5	4310	0.81
11	-24.0	3910	-6.14
12	5.8	533	10.88
13	-2.4	533	-4.50
14	6.2	533	11.63
15	-3.1	533	-5.82
16	6.2	533	11.63
17	-2.1	533	-3.94
18	8.7	4310	2.02
19	-16.7	3910	-4.27
20	7.3	533	13.70
21	-3.8	533	-7.13

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
22	7.4	533	13.88
23	-3.2	533	-6.00
24	7.4	533	13.88
25	-2.8	533	-5.25
26	7.3	533	13.70
27	-1.9	533	-3.56
28	15.3	4310	3.55
29	-8.3	3910	-2.12
30	-10.2	4310	-2.37
31	8.8	533	16.51
32	-3.6	533	-6.75
33	8.7	533	16.32
34	-4.0	533	-7.50
35	8.1	533	15.20
36	-3.0	533	-5.63
37	8.0	533	15.01
38	-2.7	533	-5.07
39	7.6	533	14.26
40	-1.9	533	-3.56
41	22.6	4310	5.24
42	-18.9	4310	-4.39
43	7.1	533	13.32
44	-2.9	533	-5.44
45	6.9	533	12.95
46	-3.3	533	-6.19
47	6.6	533	12.38
48	-2.7	533	-5.07
49	6.4	533	12.01
50	-2.2	533	-4.13
51	4.9	533	9.19
52	-14.2	1950	-7.28
53	-2.1	533	-3.94
54	30.7	4310	7.12
55	-25.6	4310	-5.94
56	4.9	533	9.19
57	-3.1	533	-5.82
58	5.0	533	9.38
59	-3.1	533	-5.82

Beam A Model

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
60	4.9	533	9.19
61	-2.0	533	-3.75
62	2.7	533	5.07
63	-15.6	1950	-8.00
64	-1.7	533	-3.19
65	1.9	533	3.56
66	-0.2	533	-0.38
67	34.9	4310	8.10
68	-30.4	4310	-7.05
69	1.9	533	3.56
70	-2.2	533	-4.13
71	2.0	533	3.75
72	-2.0	533	-3.75
73	0.8	533	1.50
74	-18.0	1950	-9.23
75	-1.7	533	-3.19
76	1.1	533	2.06
77	-1.2	533	-2.25
78	0.9	533	1.69
79	0.4	533	0.75
80	35.8	4310	8.31
81	-32.4	4310	-7.52
82	0.3	533	0.56
83	-1.1	533	-2.06
84	-0.3	533	-0.56
85	-18.9	1950	-9.69
86	-2.2	533	-4.13
87	0.1	533	0.19
88	-1.2	533	-2.25
89	0.4	533	0.75
90	-0.2	533	-0.38
91	0.6	533	1.13
92	0.6	533	1.13
93	36.0	4310	8.35
94	-32.2	4310	-7.47
95	-1.9	533	-3.56
96	-18.7	1950	-9.59
97	-2.6	533	-4.88

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
98	-1.1	533	-2.06
99	-1.5	533	-2.81
100	-0.5	533	-0.94
101	-1.0	533	-1.88
102	0.0	533	0.00
103	0.2	533	0.38
104	0.4	533	0.75
105	0.9	533	1.69
106	35.9	4310	8.33
107	-0.5	977	-0.51
108	-32.4	4310	-7.52
109	-1.8	533	-3.38
110	-1.7	533	-3.19
111	-1.1	533	-2.06
112	-1.1	533	-2.06
113	-0.6	533	-1.13
114	-0.3	533	-0.56
115	-0.2	533	-0.38
116	0.4	533	0.75
117	0.1	977	0.10
118	-32.6	4310	-7.56
119	-1.2	533	-2.25
120	-1.4	533	-2.63
121	-0.9	533	-1.69
122	-0.9	533	-1.69
123	-0.7	533	-1.31
124	-0.1	533	-0.19
125	0.7	977	0.72
126	-33.0	4310	-7.66
127	-0.9	533	-1.69
128	-1.1	533	-2.06
129	-0.8	533	-1.50
130	-0.6	533	-1.13
131	1.2	977	1.23
132	-33.2	4310	-7.70
133	-0.9	533	-1.69
134	-1.0	533	-1.88
135	1.4	977	1.43

Beam B Model

NUMBER OF JOINTS	66
NUMBER OF ELEMENTS	135
NUMBER OF LOADS	0

JOINT DATA

NODE	KODE	X	Y	U	V	R
1	10	38.0	44.5	0.0	0.0	0
2	0	38.0	148.7	0.0	0.0	0
3	0	193.0	44.5	0.0	0.0	0
4	0	38.0	252.9	0.0	0.0	0
5	0	193.0	148.7	0.0	0.0	0
6	0	348.0	44.5	0.0	0.0	0
7	0	38.0	357.1	0.0	0.0	0
8	0	193.0	252.9	0.0	0.0	0
9	0	348.0	148.7	0.0	0.0	0
10	0	503.0	44.5	0.0	0.0	0
11	0	38.0	461.3	0.0	0.0	0
12	0	193.0	357.1	0.0	0.0	0
13	0	348.0	252.9	0.0	0.0	0
14	0	503.0	148.7	0.0	0.0	0
15	0	658.0	44.5	0.0	0.0	0
16	0	38.0	565.5	0.0	0.0	0
17	0	193.0	461.3	0.0	0.0	0
18	0	348.0	357.1	0.0	0.0	0
19	0	503.0	252.9	0.0	0.0	0
20	0	658.0	148.7	0.0	0.0	0
21	0	813.0	44.5	0.0	0.0	0
22	0	193.0	565.5	0.0	0.0	0
23	0	348.0	461.3	0.0	0.0	0
24	0	503.0	357.1	0.0	0.0	0
25	0	658.0	252.9	0.0	0.0	0
26	0	813.0	148.7	0.0	0.0	0
27	0	894.4	44.5	0.0	0.0	0
28	0	348.0	565.5	0.0	0.0	0
29	0	503.0	461.3	0.0	0.0	0
30	0	658.0	357.1	0.0	0.0	0
31	0	813.0	252.9	0.0	0.0	0
32	0	894.4	148.7	0.0	0.0	0
33	0	975.8	44.5	0.0	0.0	0
34	0	503.0	565.5	0.0	0.0	0
35	0	658.0	461.3	0.0	0.0	0
36	0	813.0	357.1	0.0	0.0	0

Beam B Model

JOINT DATA

NODE	KODE	X	Y	U	V	R
37	0	894.4	252.9	0.0	0.0	0
38	0	975.8	148.7	0.0	0.0	0
39	0	1057.2	44.5	0.0	0.0	0
40	0	658.0	565.5	0.0	0.0	0
41	0	813.0	461.3	0.0	0.0	0
42	0	894.4	357.1	0.0	0.0	0
43	0	975.8	252.9	0.0	0.0	0
44	0	1057.2	148.7	0.0	0.0	0
45	0	1138.6	44.5	0.0	0.0	0
46	0	813.0	565.5	0.0	-29167.0	0
47	0	894.4	461.3	0.0	0.0	0
48	0	975.8	357.1	0.0	0.0	0
49	0	1057.2	252.9	0.0	0.0	0
50	0	1138.6	148.7	0.0	0.0	0
51	101	1220.0	44.5	0.0	0.0	0
52	0	894.4	565.5	0.0	0.0	0
53	0	975.8	461.3	0.0	0.0	0
54	0	1057.2	357.1	0.0	0.0	0
55	0	1138.6	252.9	0.0	0.0	0
56	101	1220.0	148.7	0.0	0.0	0
57	0	975.8	565.5	0.0	0.0	0
58	0	1057.2	461.3	0.0	0.0	0
59	0	1138.6	357.1	0.0	0.0	0
60	101	1220.0	252.9	0.0	0.0	0
61	0	1057.2	565.5	0.0	0.0	0
62	0	1138.6	461.3	0.0	0.0	0
63	101	1220.0	357.1	0.0	0.0	0
64	0	1138.6	565.5	0.0	0.0	0
65	101	1220.0	461.3	0.0	0.0	0
66	101	1220.0	565.5	0.0	0.0	0

Beam B Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
1	1	2	1	3900	1880000	1140
2	2	3	0	586	365000	5345
3	1	5	0	586	365000	1140
4	1	3	1	4300	2840000	9656
5	2	4	0	3900	1880000	6560
6	4	5	0	586	365000	5345
7	2	8	0	586	365000	1140
8	5	6	0	586	365000	5345
9	3	9	0	586	365000	1140
10	3	6	0	4300	2840000	9656
11	4	7	0	3900	1880000	6560
12	7	8	0	586	365000	5345
13	4	12	0	586	365000	1140
14	8	9	0	586	365000	5345
15	5	13	0	586	365000	1140
16	9	10	0	586	365000	5345
17	6	14	0	586	365000	1140
18	6	10	0	4300	2840000	9656
19	7	11	0	3900	1880000	6560
20	11	12	0	586	365000	5345
21	7	17	0	586	365000	1140
22	12	13	0	586	365000	5345
23	8	18	0	586	365000	1140
24	13	14	0	586	365000	5345
25	9	19	0	586	365000	1140
26	14	15	0	586	365000	5345
27	10	20	0	586	365000	1140
28	10	15	0	4300	2840000	9656
29	11	16	2	3900	1880000	6560
30	16	22	0	4300	2840000	9656
31	16	17	0	586	365000	5345
32	11	22	0	586	365000	1140
33	17	18	0	586	365000	5345
34	12	23	0	586	365000	1140
35	18	19	0	586	365000	5345
36	13	24	0	586	365000	1140
37	19	20	0	586	365000	5345
38	14	25	0	586	365000	1140
39	20	21	0	586	365000	5345
40	15	26	0	586	365000	1140

Beam B Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
41	15	21	0	4300	2840000	9656
42	22	28	0	4300	2840000	9656
43	22	23	0	586	365000	5345
44	17	28	0	586	365000	1140
45	23	24	0	586	365000	5345
46	18	29	0	586	365000	1140
47	24	25	0	586	365000	5345
48	19	30	0	586	365000	1140
49	25	26	0	586	365000	5345
50	20	31	0	586	365000	1140
51	26	27	0	586	365000	6560
52	21	26	1	1950	234000	5345
53	21	32	0	586	365000	5345
54	21	27	0	4300	2840000	9656
55	28	34	0	4300	2840000	9656
56	28	29	0	586	365000	5345
57	23	34	0	586	365000	1140
58	29	30	0	586	365000	5345
59	24	35	0	586	365000	1140
60	30	31	0	586	365000	5345
61	25	36	0	586	365000	1140
62	31	32	0	586	365000	6560
63	26	31	0	1950	234000	5345
64	26	37	0	586	365000	5345
65	32	33	0	586	365000	5345
66	27	38	0	586	365000	5345
67	27	33	0	4300	2840000	9656
68	34	40	1	4300	2840000	9656
69	34	35	0	586	365000	5345
70	29	40	0	586	365000	1140
71	35	36	0	586	365000	5345
72	30	41	0	586	365000	1140
73	36	37	0	586	365000	6560
74	31	36	0	1950	234000	5345
75	31	42	0	586	365000	5345
76	37	38	0	586	365000	5345
77	32	43	0	586	365000	5345
78	38	39	0	586	365000	5345
79	33	44	0	586	365000	5345
80	33	39	0	4300	2840000	9656

Beam B Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
81	40	46	0	4300	2840000	9656
82	40	41	0	586	365000	5345
83	35	46	0	586	365000	1140
84	41	42	0	586	365000	6560
85	36	41	0	1950	234000	5345
86	36	47	0	586	365000	5345
87	42	43	0	586	365000	5345
88	37	48	0	586	365000	5345
89	43	44	0	586	365000	5345
90	38	49	0	586	365000	5345
91	44	45	0	586	365000	5345
92	39	50	0	586	365000	5345
93	39	45	0	4300	2840000	9656
94	46	52	0	4300	2840000	9656
95	46	47	0	586	365000	6560
96	41	46	2	1950	234000	5345
97	41	52	0	586	365000	5345
98	47	48	0	586	365000	5345
99	42	53	0	586	365000	5345
100	48	49	0	586	365000	5345
101	43	54	0	586	365000	5345
102	49	50	0	586	365000	5345
103	44	55	0	586	365000	5345
104	50	51	0	586	365000	5345
105	45	56	0	586	365000	5345
106	45	51	0	4300	2840000	9656
107	51	56	1	974	117000	6560
108	52	57	0	4300	2840000	9656
109	52	53	0	586	365000	5345
110	47	57	0	586	365000	5345
111	53	54	0	586	365000	5345
112	48	58	0	586	365000	5345
113	54	55	0	586	365000	5345
114	49	59	0	586	365000	5345
115	55	56	0	586	365000	5345
116	50	60	0	586	365000	5345
117	56	60	0	974	117000	6560
118	57	61	0	4300	2840000	9656
119	57	58	0	586	365000	5345
120	53	61	0	586	365000	5345

Beam B Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
121	58	59	0	586	365000	5345
122	54	62	0	586	365000	5345
123	59	60	0	586	365000	5345
124	55	63	0	586	365000	5345
125	60	63	0	974	117000	6560
126	61	64	0	4300	2840000	9656
127	61	62	0	586	365000	5345
128	58	64	0	586	365000	5345
129	62	63	0	586	365000	5345
130	59	65	0	586	365000	5345
131	63	65	0	974	117000	6560
132	64	66	0	4300	2840000	9656
133	64	65	0	586	365000	5345
134	62	66	0	586	365000	5345
135	65	66	0	974	117000	6560

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
1	-0.64	+0.00	-1.14E-02
2	-0.06	-0.63	-4.70E-03
3	-0.63	-1.66	-1.04E-02
4	+0.40	-0.73	-4.02E-03
5	-0.05	-1.88	-7.52E-03
6	-0.62	-3.24	-1.00E-02
7	+0.75	-0.82	-2.74E-03
8	+0.26	-2.14	-8.62E-03
9	-0.17	-3.49	-6.56E-03
10	-0.58	-4.80	-9.94E-03
11	+0.92	-0.87	-9.32E-04
12	+0.53	-2.23	-9.32E-03
13	+0.09	-3.73	-7.35E-03
14	-0.21	-5.01	-6.22E-03
15	-0.50	-6.30	-9.12E-03
16	+0.91	-0.90	-1.23E-02
17	+0.49	-2.51	-7.09E-03

Beam B Model

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
18	+0.22	-3.87	-7.05E-03
19	-0.04	-5.17	-6.64E-03
20	-0.25	-6.39	-5.93E-03
21	-0.40	-7.49	-5.47E-03
22	+0.86	-2.81	-1.21E-02
23	+0.44	-4.27	-6.32E-03
24	+0.17	-5.46	-6.44E-03
25	-0.10	-6.61	-6.36E-03
26	-0.29	-7.60	-2.20E-03
27	-0.33	-7.83	-3.08E-03
28	+0.78	-4.64	-1.13E-02
29	+0.38	-5.85	-5.28E-03
30	+0.12	-6.82	-5.87E-03
31	-0.11	-7.72	-2.17E-03
32	-0.14	-7.85	-1.40E-03
33	-0.25	-8.03	-1.89E-03
34	+0.67	-6.36	-1.06E-02
35	+0.29	-7.24	-3.86E-03
36	+0.06	-7.84	-1.91E-03
37	-0.04	-7.93	-1.71E-03
38	-0.11	-8.05	-1.24E-03
39	-0.17	-8.15	-1.12E-03
40	+0.53	-7.41	-6.06E-03
41	+0.22	-7.97	-1.59E-03
42	+0.11	-8.01	-1.36E-03
43	+0.02	-8.07	-1.25E-03
44	-0.07	-8.17	-9.14E-04
45	-0.08	-8.22	-5.33E-04
46	+0.39	-8.10	-2.26E-03
47	+0.23	-8.12	-1.01E-03
48	+0.11	-8.13	-9.86E-04
49	+0.02	-8.18	-8.09E-04
50	-0.03	-8.23	-4.36E-04
51	+0.00	-8.24	+0.00E+00
52	+0.31	-8.20	-5.23E-04
53	+0.20	-8.18	-6.27E-04
54	+0.09	-8.20	-6.14E-04
55	+0.01	-8.24	-3.88E-04
56	+0.00	-8.25	+0.00E+00

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
57	+0.23	-8.22	-2.23E-05
58	+0.14	-8.21	-3.42E-04
59	+0.05	-8.24	-2.70E-04
60	+0.00	-8.25	+0.00E+00
61	+0.15	-8.22	+3.03E-05
62	+0.07	-8.23	-1.41E-04
63	+0.00	-8.24	+0.00E+00
64	+0.08	-8.22	-1.57E-05
65	+0.00	-8.23	+0.00E+00
66	+0.00	-8.22	+0.00E+00

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress ((MPa)
1	-26.8	3900	-6.87
2	1.6	586	2.73
3	-2.0	586	-3.41
4	1.1	4300	0.26
5	-25.3	3900	-6.49
6	4.5	586	7.68
7	-2.1	586	-3.58
8	4.9	586	8.36
9	-2.3	586	-3.92
10	4.7	4300	1.09
11	-20.9	3900	-5.36
12	5.7	586	9.73
13	-2.6	586	-4.44
14	6.5	586	11.09
15	-3.3	586	-5.63
16	6.7	586	11.43
17	-2.3	586	-3.92
18	11.0	4300	2.56
19	-14.3	3900	-3.67
20	7.2	586	12.29
21	-4.1	586	-7.00

Beam B Model

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
22	7.8	586	13.31
23	-3.6	586	-6.14
24	7.8	586	13.31
25	-2.9	586	-4.95
26	8.0	586	13.65
27	-2.2	586	-3.75
28	18.8	4300	4.37
29	-6.6	3900	-1.69
30	-11.9	4300	-2.77
31	9.2	586	15.70
32	-4.1	586	-7.00
33	9.0	586	15.36
34	-4.3	586	-7.34
35	8.5	586	14.51
36	-3.2	586	-5.46
37	8.5	586	14.51
38	-2.9	586	-4.95
39	8.2	586	13.99
40	-1.9	586	-3.24
41	27.4	4300	6.37
42	-22.1	4300	-5.14
43	7.8	586	13.31
44	-3.4	586	-5.80
45	7.4	586	12.63
46	-3.5	586	-5.97
47	7.1	586	12.12
48	-2.8	586	-4.78
49	6.7	586	11.43
50	-2.2	586	-3.75
51	4.5	586	7.68
52	-11.1	1950	-5.69
53	-2.9	586	-4.95
54	36.7	4300	8.53
55	-30.2	4300	-7.02
56	5.7	586	9.73
57	-3.5	586	-5.97
58	5.5	586	9.39
59	-3.2	586	-5.46

Beam B Model

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress
60	5.2	586	8.87
61	-2.0	586	-3.41
62	2.6	586	4.44
63	-11.3	1950	-5.79
64	-2.5	586	-4.27
65	1.8	586	3.07
66	-0.8	586	-1.37
67	41.4	4300	9.63
68	-36.2	4300	-8.42
69	3.0	586	5.12
70	-2.7	586	-4.61
71	2.5	586	4.27
72	-2.0	586	-3.41
73	0.3	586	0.51
74	-12.4	1950	-6.36
75	-2.4	586	-4.10
76	1.2	586	2.05
77	-1.8	586	-3.07
78	1.1	586	1.88
79	0.2	586	0.34
80	42.2	4300	9.81
81	-39.1	4300	-9.09
82	0.8	586	1.37
83	-1.4	586	-2.39
84	-1.1	586	-1.88
85	-13.1	1950	-6.72
86	-2.8	586	-4.78
87	-0.2	586	-0.34
88	-1.6	586	-2.73
89	0.6	586	1.02
90	-0.7	586	-1.19
91	0.8	586	1.37
92	0.5	586	0.85
93	42.5	4300	9.88
94	-39.4	4300	-9.16
95	-2.6	586	-4.44
96	-13.3	1950	-6.82
97	-3.0	586	-5.12

Beam B Model

MEMBER STRESSES

Member	Axial Force (kN)	Area (mm^2)	Stress (MPa)
98	-1.3	586	-2.22
99	-1.8	586	-3.07
100	-0.4	586	-0.68
101	-1.2	586	-2.05
102	0.2	586	0.34
103	-0.1	586	-0.17
104	0.6	586	1.02
105	0.7	586	1.19
106	42.6	4300	9.91
107	-0.3	974	-0.31
108	-39.4	4300	-9.16
109	-2.1	586	-3.58
110	-1.9	586	-3.24
111	-1.1	586	-1.88
112	-1.1	586	-1.88
113	-0.4	586	-0.68
114	-0.5	586	-0.85
115	0.0	586	0.00
116	0.2	586	0.34
117	0.0	974	0.00
118	-39.3	4300	-9.14
119	-1.5	586	-2.56
120	-1.4	586	-2.39
121	-0.9	586	-1.54
122	-0.9	586	-1.54
123	-0.5	586	-0.85
124	-0.3	586	-0.51
125	0.4	974	0.41
126	-39.4	4300	-9.16
127	-1.0	586	-1.71
128	-1.0	586	-1.71
129	-0.8	586	-1.37
130	-0.6	586	-1.02
131	0.6	974	0.62
132	-39.5	4300	-9.19
133	-0.9	586	-1.54
134	-0.9	586	-1.54
135	0.8	974	0.82

Beam C Model

NUMBER OF JOINTS	66
NUMBER OF ELEMENTS	135
NUMBER OF LOADS	0

JOINT DATA

NODE	KODE	X	Y	U	V	R
1	10	38.0	44.5	0.0	0.0	0
2	0	38.0	148.6	0.0	0.0	0
3	0	152.3	44.5	0.0	0.0	0
4	0	38.0	252.7	0.0	0.0	0
5	0	152.3	148.6	0.0	0.0	0
6	0	266.6	44.5	0.0	0.0	0
7	0	38.0	356.9	0.0	0.0	0
8	0	152.3	252.7	0.0	0.0	0
9	0	266.6	148.6	0.0	0.0	0
10	0	381.0	44.5	0.0	0.0	0
11	0	38.0	461.0	0.0	0.0	0
12	0	152.3	356.9	0.0	0.0	0
13	0	266.6	252.7	0.0	0.0	0
14	0	381.0	148.6	0.0	0.0	0
15	0	495.3	44.5	0.0	0.0	0
16	0	38.0	565.1	0.0	0.0	0
17	0	152.3	461.0	0.0	0.0	0
18	0	266.6	356.9	0.0	0.0	0
19	0	381.0	252.7	0.0	0.0	0
20	0	495.3	148.6	0.0	0.0	0
21	0	609.6	44.5	0.0	0.0	0
22	0	152.3	565.1	0.0	0.0	0
23	0	266.6	461.0	0.0	0.0	0
24	0	381.0	356.9	0.0	0.0	0
25	0	495.3	252.7	0.0	0.0	0
26	0	609.6	148.6	0.0	0.0	0
27	0	731.7	44.5	0.0	0.0	0
28	0	266.6	565.1	0.0	0.0	0
29	0	381.0	461.0	0.0	0.0	0
30	0	495.3	356.9	0.0	0.0	0
31	0	609.6	252.7	0.0	0.0	0
32	0	731.7	148.6	0.0	0.0	0
33	0	853.8	44.5	0.0	0.0	0
34	0	381.0	565.1	0.0	0.0	0
35	0	495.3	461.0	0.0	0.0	0
36	0	609.6	356.9	0.0	0.0	0

Beam C Model

JOINT DATA

NODE	KODE	X	Y	U	V	R
37	0	731.7	252.7	0.0	0.0	0
38	0	853.8	148.6	0.0	0.0	0
39	0	975.8	44.5	0.0	0.0	0
40	0	495.3	565.1	0.0	0.0	0
41	0	609.6	461.0	0.0	0.0	0
42	0	731.7	356.9	0.0	0.0	0
43	0	853.8	252.7	0.0	0.0	0
44	0	975.8	148.6	0.0	0.0	0
45	0	1097.9	44.5	0.0	0.0	0
46	0	609.6	565.1	0.0	-26833.0	0
47	0	731.7	461.0	0.0	0.0	0
48	0	853.8	356.9	0.0	0.0	0
49	0	975.8	252.7	0.0	0.0	0
50	0	1097.9	148.6	0.0	0.0	0
51	101	1220.0	44.5	0.0	0.0	0
52	0	731.7	565.1	0.0	0.0	0
53	0	853.8	461.0	0.0	0.0	0
54	0	975.8	356.9	0.0	0.0	0
55	0	1097.9	252.7	0.0	0.0	0
56	101	1220.0	148.6	0.0	0.0	0
57	0	853.8	565.1	0.0	0.0	0
58	0	975.8	461.0	0.0	0.0	0
59	0	1097.9	356.9	0.0	0.0	0
60	101	1220.0	252.7	0.0	0.0	0
61	0	975.8	565.1	0.0	0.0	0
62	0	1097.9	461.0	0.0	0.0	0
63	101	1220.0	356.9	0.0	0.0	0
64	0	1097.9	565.1	0.0	0.0	0
65	101	1220.0	461.0	0.0	0.0	0
66	101	1220.0	565.1	0.0	0.0	0

Beam C Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
1	1	2	1	3840	1850000	1816
2	2	3	0	465	230000	3978
3	1	5	0	465	230000	1816
4	1	3	1	4140	2740000	9455
5	2	4	0	3840	1850000	6560
6	4	5	0	465	230000	3978
7	2	8	0	465	230000	1816
8	5	6	0	465	230000	3978
9	3	9	0	465	230000	1816
10	3	6	0	4140	2740000	9455
11	4	7	0	3840	1850000	6560
12	7	8	0	465	230000	3978
13	4	12	0	465	230000	1816
14	8	9	0	465	230000	3978
15	5	13	0	465	230000	1816
16	9	10	0	465	230000	3978
17	6	14	0	465	230000	1816
18	6	10	0	4140	2740000	9455
19	7	11	0	3840	1850000	6560
20	11	12	0	465	230000	3978
21	7	17	0	465	230000	1816
22	12	13	0	465	230000	3978
23	8	18	0	465	230000	1816
24	13	14	0	465	230000	3978
25	9	19	0	465	230000	1816
26	14	15	0	465	230000	3978
27	10	20	0	465	230000	1816
28	10	15	0	4140	2740000	9455
29	11	16	2	3840	1850000	6560
30	16	22	0	4140	2740000	9455
31	16	17	0	465	230000	3978
32	11	22	0	465	230000	1816
33	17	18	0	465	230000	3978
34	12	23	0	465	230000	1816
35	18	19	0	465	230000	3978
36	13	24	0	465	230000	1816
37	19	20	0	465	230000	3978
38	14	25	0	465	230000	1816
39	20	21	0	465	230000	3978
40	15	26	0	465	230000	1816

Beam C Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
81	40	46	0	4140	2740000	9455
82	40	41	0	465	230000	3978
83	35	46	0	465	230000	1816
84	41	42	0	465	230000	6560
85	36	41	0	1920	231000	3978
86	36	47	0	465	230000	3978
87	42	43	0	465	230000	3978
88	37	48	0	465	230000	3978
89	43	44	0	465	230000	3978
90	38	49	0	465	230000	3978
91	44	45	0	465	230000	3978
92	39	50	0	465	230000	3978
93	39	45	0	4140	2740000	9455
94	46	52	0	4140	2740000	9455
95	46	47	0	465	230000	6560
96	41	46	2	1920	231000	3978
97	41	52	0	465	230000	3978
98	47	48	0	465	230000	3978
99	42	53	0	465	230000	3978
100	48	49	0	465	230000	3978
101	43	54	0	465	230000	3978
102	49	50	0	465	230000	3978
103	44	55	0	465	230000	3978
104	50	51	0	465	230000	3978
105	45	56	0	465	230000	3978
106	45	51	0	4140	2740000	9455
107	51	56	1	960	116000	6560
108	52	57	0	4140	2740000	9455
109	52	53	0	465	230000	3978
110	47	57	0	465	230000	3978
111	53	54	0	465	230000	3978
112	48	58	0	465	230000	3978
113	54	55	0	465	230000	3978
114	49	59	0	465	230000	3978
115	55	56	0	465	230000	3978
116	50	60	0	465	230000	3978
117	56	60	0	960	116000	6560
118	57	61	0	4140	2740000	9455
119	57	58	0	465	230000	3978
120	53	61	0	465	230000	3978

Beam C Model

ELEMENT DATA

ELEMENT	I	J	MKODE	AREA	I	E
121	58	59	0	465	230000	3978
122	54	62	0	465	230000	3978
123	59	60	0	465	230000	3978
124	55	63	0	465	230000	3978
125	60	63	0	960	116000	6560
126	61	64	0	4140	2740000	9455
127	61	62	0	465	230000	3978
128	58	64	0	465	230000	3978
129	62	63	0	465	230000	3978
130	59	65	0	465	230000	3978
131	63	65	0	960	116000	6560
132	64	66	0	4140	2740000	9455
133	64	65	0	465	230000	3978
134	62	66	0	465	230000	3978
135	65	66	0	960	116000	6560

NODAL DISPLACEMENTS

NODE	U (mm)	V (mm)	ROT (rad)
1	-0.61	+0.00	-8.17E-03
2	-0.28	-0.35	-2.94E-03
3	-0.60	-1.04	-8.89E-03
4	+0.01	-0.44	-2.65E-03
5	-0.22	-1.17	-5.43E-03
6	-0.59	-2.04	-8.51E-03
7	+0.27	-0.50	-2.31E-03
8	-0.04	-1.35	-6.12E-03
9	-0.28	-2.16	-4.57E-03
10	-0.55	-2.99	-8.02E-03
11	+0.48	-0.54	-1.90E-03
12	+0.17	-1.43	-6.45E-03
13	-0.08	-2.28	-5.11E-03
14	-0.28	-3.07	-4.44E-03
15	-0.50	-3.86	-7.06E-03
16	+0.64	-0.56	-9.69E-03
17	+0.28	-1.54	-5.26E-03

Beam C Model

NODE	U (mm)	V (mm)	ROT (rad)
18	+0.06	-2.40	-5.20E-03
19	-0.13	-3.17	-4.82E-03
20	-0.29	-3.90	-4.14E-03
21	-0.44	-4.56	-4.96E-03
22	+0.63	-1.67	-9.74E-03
23	+0.26	-2.60	-4.80E-03
24	+0.06	-3.35	-4.89E-03
25	-0.12	-4.04	-4.70E-03
26	-0.26	-4.67	-2.27E-03
27	-0.36	-5.02	-2.79E-03
28	+0.60	-2.79	-9.71E-03
29	+0.25	-3.58	-4.34E-03
30	+0.07	-4.21	-4.65E-03
31	-0.09	-4.79	-2.13E-03
32	-0.18	-5.02	-1.86E-03
33	-0.27	-5.29	-1.77E-03
34	+0.55	-3.90	-9.53E-03
35	+0.24	-4.48	-3.53E-03
36	+0.07	-4.94	-2.02E-03
37	-0.03	-5.11	-1.94E-03
38	-0.13	-5.32	-1.54E-03
39	-0.18	-5.47	-1.13E-03
40	+0.49	-4.70	-6.42E-03
41	+0.23	-5.11	-1.80E-03
42	+0.12	-5.23	-1.61E-03
43	+0.02	-5.36	-1.55E-03
44	-0.08	-5.51	-1.04E-03
45	-0.09	-5.57	-5.86E-04
46	+0.42	-5.29	-3.58E-03
47	+0.26	-5.40	-1.05E-03
48	+0.15	-5.44	-1.17E-03
49	+0.03	-5.54	-9.39E-04
50	-0.03	-5.61	-4.50E-04
51	+0.00	-5.61	+0.00E+00
52	+0.34	-5.54	-8.49E-04
53	+0.23	-5.51	-6.60E-04
54	+0.12	-5.56	-6.82E-04
55	+0.02	-5.62	-3.69E-04
56	+0.00	-5.62	+0.00E+00
57	+0.25	-5.58	-2.62E-05
58	+0.17	-5.57	-3.02E-04

NODE	U (mm)	V (mm)	ROT (rad)
59	+0.06	-5.61	-2.22E-04
60	+0.00	-5.62	+0.00E+00
61	+0.17	-5.57	+3.87E-05
62	+0.08	-5.59	-1.03E-04
63	+0.00	-5.61	+0.00E+00
64	+0.08	-5.57	-6.82E-05
65	+0.00	-5.60	+0.00E+00
66	+0.00	-5.58	+0.00E+00

FINAL MEMBER FORCES

MEMBER	Axial Force (kN)	Area (mm^2)	Stress (MPa)
1	-23.7	3840	-6.17
2	2.6	465	5.59
3	-2.7	465	-5.81
4	1.7	4140	0.41
5	-20.3	3840	-5.29
6	3.8	465	8.17
7	-2.7	465	-5.81
8	3.8	465	8.17
9	-2.8	465	-6.02
10	6.1	4140	1.47
11	-15.5	3840	-4.04
12	4.1	465	8.82
13	-3.0	465	-6.45
14	4.4	465	9.46
15	-3.5	465	-7.53
16	4.3	465	9.25
17	-2.6	465	-5.59
18	11.2	4140	2.71
19	-9.6	3840	-2.50
20	4.4	465	9.46
21	-3.8	465	-8.17
22	4.6	465	9.89

FINAL MEMBER FORCES

MEMBER	Axial Force (kN)	Area (mm^2)	Stress (MPa)
23	-3.5	465	-7.53
24	4.6	465	9.89
25	-3.1	465	-6.67
26	4.4	465	9.46
27	-2.3	465	-4.95
28	16.5	4140	3.99
29	-3.7	3840	-0.96
30	-4.9	4140	-1.18
31	4.7	465	10.11
32	-3.6	465	-7.74
33	4.9	465	10.54
34	-4.0	465	-8.60
35	4.6	465	9.89
36	-3.3	465	-7.10
37	4.5	465	9.68
38	-2.9	465	-6.24
39	4.0	465	8.60
40	-2.0	465	-4.30
41	21.5	4140	5.19
42	-11.0	4140	-2.66
43	4.2	465	9.03
44	-3.3	465	-7.10
45	4.2	465	9.03
46	-3.6	465	-7.74
47	4.0	465	8.60
48	-3.0	465	-6.45
49	3.8	465	8.17
50	-2.5	465	-5.38
51	2.9	465	6.24
52	-7.7	1920	-4.01
53	-1.1	465	-2.37
54	25.7	4140	6.21
55	-16.4	4140	-3.96
56	3.3	465	7.10
57	-3.6	465	-7.74
58	3.4	465	7.31
59	-3.4	465	-7.31
60	3.2	465	6.88

Beam C Model

FINAL MEMBER FORCES

MEMBER	Axial Force (kN)	Area (mm^2)	Stress (MPa)
61	-2.5	465	-5.38
62	1.6	465	3.44
63	-8.8	1920	-4.58
64	-1.3	465	-2.80
65	1.2	465	2.58
66	-0.2	465	-0.43
67	28.3	4140	6.84
68	-21.3	4140	-5.14
69	2.0	465	4.30
70	-3.1	465	-6.67
71	2.1	465	4.52
72	-2.7	465	-5.81
73	0.7	465	1.51
74	-10.9	1920	-5.68
75	-1.4	465	-3.01
76	0.7	465	1.51
77	-0.8	465	-1.72
78	0.6	465	1.29
79	0.1	465	0.22
80	29.0	4140	7.00
81	-24.5	4140	-5.92
82	1.0	465	2.15
83	-2.3	465	-4.95
84	0.0	465	0.00
85	-12.6	1920	-6.56
86	-1.9	465	-4.09
87	0.1	465	0.22
88	-0.9	465	-1.94
89	0.3	465	0.65
90	-0.2	465	-0.43
91	0.4	465	0.86
92	0.3	465	0.65
93	29.3	4140	7.08
94	-25.8	4140	-6.23
95	-1.0	465	-2.15
96	-13.6	1920	-7.08
97	-2.2	465	-4.73
98	-0.6	465	-1.29

Beam C Model

FINAL MEMBER FORCES

MEMBER	Axial Force (kN)	Area (mm^2)	Stress (MPa)
99	-1.1	465	-2.37
100	-0.3	465	-0.65
101	-0.6	465	-1.29
102	0.0	465	0.00
103	0.0	465	0.00
104	0.2	465	0.43
105	0.5	465	1.08
106	29.2	4140	7.05
107	-0.3	960	-0.31
108	-26.5	4140	-6.40
109	-1.1	465	-2.37
110	-1.3	465	-2.80
111	-0.7	465	-1.51
112	-0.8	465	-1.72
113	-0.4	465	-0.86
114	-0.3	465	-0.65
115	-0.2	465	-0.43
116	0.2	465	0.43
117	0.0	960	0.00
118	-26.8	4140	-6.47
119	-0.8	465	-1.72
120	-1.0	465	-2.15
121	-0.6	465	-1.29
122	-0.6	465	-1.29
123	-0.5	465	-1.08
124	-0.1	465	-0.22
125	0.5	960	0.52
126	-27.1	4140	-6.55
127	-0.6	465	-1.29
128	-0.7	465	-1.51
129	-0.6	465	-1.29
130	-0.4	465	-0.86
131	0.8	960	0.83
132	-27.2	4140	-6.57
133	-0.6	465	-1.29
134	-0.6	465	-1.29
135	0.9	960	0.94

APPENDIX D

Sample Calculations

Sample Calculations

1. Critical Shear Force

Type A beam
Beam:

610 mm deep with 89 mm X 89 mm flanges and two 6.35 mm thick OSB webs.

Webs:

Panel size	515 mm horizontal X 432 mm vertical, 6.92 mm thick
Elastic Moduli	3780 MPa parallel, 4040 MPa perpendicular
Shear Modulus	1515 MPa
Poisson's Ratio	0.30 parallel (assumed), 0.28 perpendicular (assumed)

Flanges:

Size 89 mm X 89 mm, E = 10,300 MPa

Constants for use with Figure 2.3:

$$\alpha = \frac{b}{a}\sqrt[4]{\frac{E_{wa}}{E_{wb}}} \leq 1 \qquad 2.10$$

$$\alpha = \frac{432}{515}\sqrt[4]{\frac{3\ 780}{4\ 040}}$$

$$\alpha = 0.825$$

$$\beta = \frac{0.17\,E_L}{\sqrt{E_a E_b}} \leq 1 \qquad 2.8$$

where

$$E_L = \frac{20}{21}\ (E_{wa} + E_{wb}) \qquad 2.9$$

$$\beta = \frac{20\ x\ 0.17\ x\ (3\ 780 + 4\ 040)}{21\ x\ \sqrt{3\ 780\ x\ 4\ 040}}$$

Sample Calculations

$$\beta = 0.324$$

From Figure 2.3, $K_s = 13.2$

Critical shear stress

$$v_{cr} = \frac{K_s t^2}{3b^2 (1 - \nu_a \nu_b)} \sqrt[4]{E_a E_b^3} \qquad 2.13$$

$$v_{cr} = \frac{13.2 \times 6.92^2}{3 \times 432^2 \ (1 - 0.30 \times 0.275)} \sqrt[4]{3\ 780 \times 4\ 040^3}$$

$$v_{cr} = 4.90 \ MPa$$

Critical shear force per panel

$$V_{cr} = \frac{v_{cr} I_w^T t}{Q_w^T} \qquad 2.33$$

where

$$I_w^T = \frac{b_f}{12} (h^3 - c^3) \frac{E_f}{E_{wx}} + \frac{2 t h^3}{12}$$

$$I_w^T = \frac{89}{12} (610^3 - 432^3) \frac{10\ 300}{3\ 780} + \frac{2 \times 6.92 \times 610^3}{12}$$

$$I_w^T = 3.22 \times 10^9 \ mm^4$$

and

$$Q_w^T = \frac{h_f b_f (h - h_f)}{2} \frac{E_f}{E_{wx}} + \frac{2\,t h^2}{8}$$

$$Q_w^T = \frac{89 \times 89 \; (610 - 89)}{2} \frac{10\,300}{3\,780} + \frac{2 \times 6.92 \times 610^2}{8}$$

$$Q_w^T = 6.27 \times 10^6 \; mm^3$$

$$V_{cr} = \frac{4.90 \times 3.22 \times 10^9 \times 6.92}{6.27 \times 10^6}$$

$$V_{cr} = 17.4 \; kN \quad per\ panel$$

Sample Calculations

2. Shear Deflection - Beam A - 100 kN total load

$$M = \frac{Pa}{2}$$

$$M = \frac{100\ 000 \times 547.1}{2}$$

$$M = 27.36\ kN\text{-}m$$

Wood Handbook (1987) Method

$$\Delta_s = \frac{M}{G\ c\ \Sigma t} \qquad 2.26$$

$$\Delta_s = \frac{27.36 \times 10^6}{1515 \times 432 \times 2 \times 6.92}$$

$$\Delta_s = 3.02\ mm$$

CAN/CSA O86.1-M89 (1989) Method

$$\Delta_s = \frac{\Sigma B_a\ M\ h^2\ X_s}{\Sigma B_v\ (EI)_e} \qquad 2.21$$

where

$$(EI)_e = I_w^T E_{wx}$$

$$(EI)_e = 3.22 \times 10^9 \times 3\,780$$

$$(EI)_e = 1.22 \times 10^{13}\ N\text{-}mm^2$$

$$\Delta_s = \frac{3\,780}{1\,515}\ \frac{27.36 \times 10^6 \times 610^2 \times 0.44}{1.217 \times 10^{13}}$$

$$\Delta_s = 0.92\ mm$$

American Plywood Association (1986) Method

$$\Delta_s = \frac{K\,M}{A\,G} \qquad 2.34$$

From Equation 2.35, K = 3.07

$$\Delta_s = \frac{3.07 \times 27.36 \times 10^6}{24\,300 \times 1\,515}$$

$$\Delta_s = 2.28\ mm$$